

# NEW TECHNOLOGY JAPAN



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## INNOVATIVE PRODUCTION NOW

*Advanced Power Semiconductor  
Manufacturing Plants for the Key  
Component Age  
-Shika and Uchiura Factories of  
Ishikawa Sanken Co., Ltd.-*

## Topics

*Innovative High-Efficiency Rotating  
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## NATIONAL R&D PROJECTS

*National Research and Development  
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## GENERIC TECHNOLOGY REVIEW

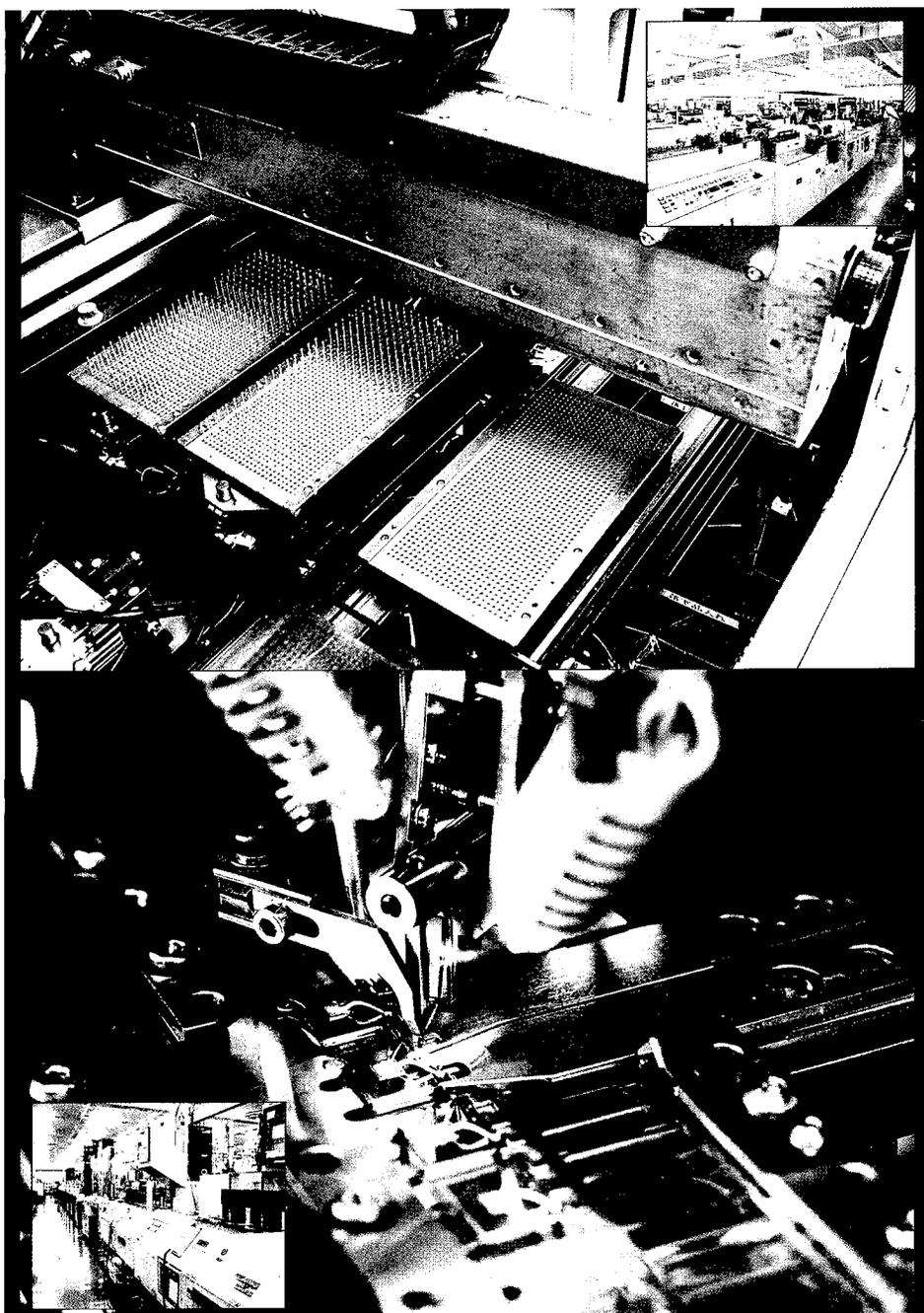
*Research on Oxide Semiconductor  
Optoelectronics  
Bionics: Study of the mechanism of  
information control in neural cell  
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## HIGH-TECH INFORMATION

*Amplification of Stratified Tunnel  
Type Magnetoresistance Effect  
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Respiration Muscle Function  
Measurement System Developed  
Successfully*

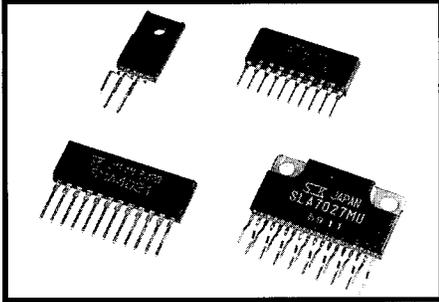
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**Cover Photo:** Advanced Power Semiconductor Manufacturing Plants for the Key Component Age - Shika and Uchiura Factories of Ishikawa Sanken Co., Ltd.-(Story on Pages2-5)

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# INNOVATIVE PRODUCTION NOW

*This section describes a specialized section or whole process of a representative factory which excels in specific aspects of production.*

## *Advanced Power Semiconductor Manufacturing Plants for the Key Component Age - Shika and Uchiura Factories of Ishikawa Sanken Co., Ltd.*

### Introduction

Along with the advance of the world-wide operation of electronics industry, procurement of quality and high performance electronic component and parts such as semiconductors including hybrid IC, diodes, etc. has become essential for the assembly manufacturers of electric and electronic equipment and products.

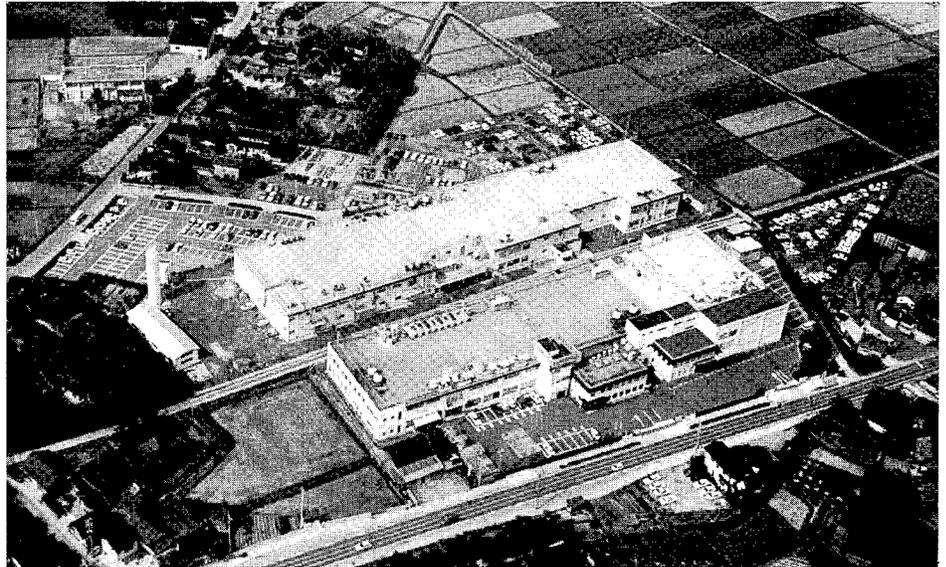
The world's leading semiconductor manufacturers are making efforts to achieve quality and high performance products with lower costs to gain greater shares in the world market.

Sanken Electric Co., Ltd., a leading power semiconductor manufacturer in Japan, has gained a 60% of the share of regulator ICs in the world market for use in TVs produced worldwide, 30 to 40 % share of alternator diodes for automobiles, and 30 - 40% share of motor drive ICs for information devices including office automation devices such as facsimiles, copying machines, etc.

Such large shares have established that their products are highly evaluated by the users for quality, performance, costs, and easy assembly concepts.

Sanken Electric Co. has established production subsidiaries, and their products are sent to the headquarters, and distributed to end users located worldwide. The largest production subsidiary of Sanken Electric is Ishikawa Sanken Co., Ltd.

This issue introduces the Shika and Uchiura factories, the main production plants of the company.



*Aerial view of Shika Factory for production of hybrid ICs, transistors and transistor arrays*

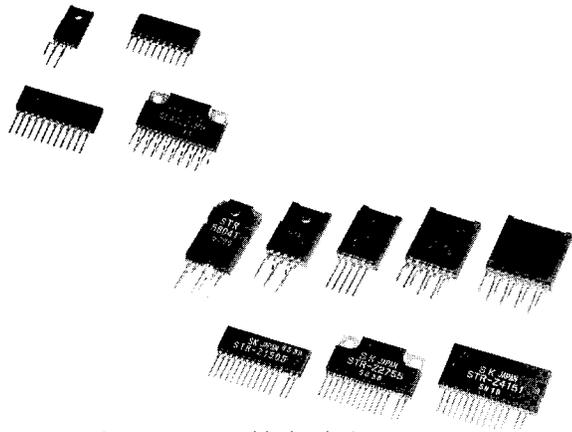
### **2. Unique Establishment of Ishikawa Sanken Co.**

At present, Ishikawa Sanken Co., located in the Ishikawa Prefecture, has five factories including the head office factory called Shika Factory, Uchiura Factory, Machino Factory, Monzen Factory and Hakusan Factory. However, the establishment style of Ishikawa Sanken Co. is unique. At first, these five factories were established between 1964 and 1970 separately as independent production companies by joint-venture with the local leading industrial, commercial and agricultural associations including local governments, as the first in Japan. So the investment share was 51% for local associations and 49% for Sanken Electric, and the presidency was shared by the leaders of local associations. Such establishment style

was adapted to Sanken's management strategy, and the strong desire to create employment opportunities in the local areas and prevent the outflow of young people, and promote the call back of young people living in the large cities to vitalize local economies. These expectations and ideas of the established company were accomplished, and as a result, these five companies were merged as Ishikawa Sanken Co. with 100% ownership of Sanken Electric in 1988.

### **3. Shika Factory (1) Outline of the Factory**

The head office and Shika factory is located at the base of the Noto Peninsula, Ishikawa Pref., and takes 1 hour to Komatsu Airport from Tokyo International Airport by airline, and about 1 hour



Various types of transistors and hybrid ICs



SAFAIA line for hybrid IC production

30 minutes from Komatsu Airport to the plant site via highway bus or JR lines.

The head office and Shika Factory was constructed in Nov. 1964, and remodelled and expanded several times according to increase of demand needs. At present, the plant has a land area with 24,382 m<sup>2</sup>, and consists of two buildings with total building areas of 23,145 m<sup>2</sup> including the head office, and 762 employees.

The production buildings are divided by the cycling road for local people, which was formerly used as the JR railroad, so these two buildings are connected by an underpass for carrying parts and finished products, and transfer of stocks. Therefore, unique transfer systems for carrying of parts or shipment of finished products are used along or underpass.

### (2) Products & Production Capacity

The factory produces various types power transistors, power MOSFETs, thyristors, triac, and transistor arrays, and hy-

brid ICs. The discrete products are supplied to the manufacturers of audio amplifiers, TVs, VTRs, monitor, OA equipment, cooking devices, transistor arrays to monitors, OA equipment, and automobiles, and hybrid ICs to telecommunications equipment, monitors, OA equipment, lithium cell chargers and mini-audio compos., and are mainly used for power supply control.

The production capacity of the factory is about 25 million units/month on average.

### (3) Production Lines

This factory is an assembly plant to produce the various types of products mentioned above using the components and parts produced and supplied by affiliates and outer suppliers.

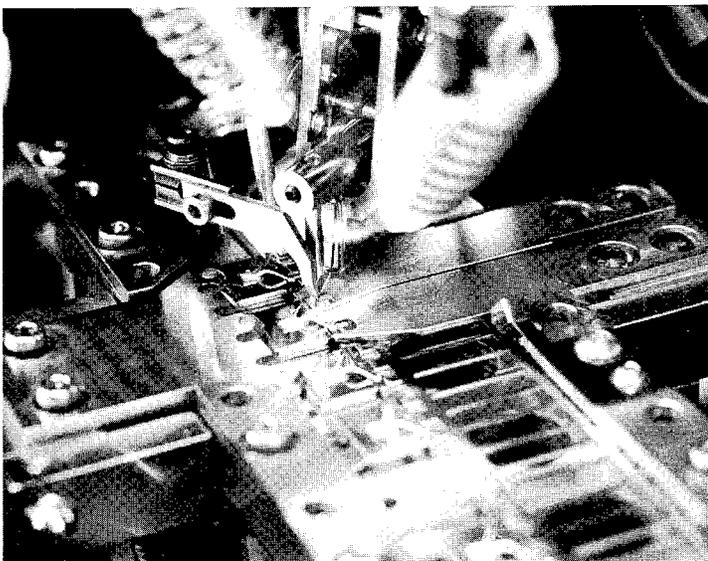
Production is based on the order which specifies the type of products and quantity indicated by headquarters. There are very small lot to large lot orders. So, the production copes with multi-type/small lot

production, and large lot products in the same lines. Accordingly, several sets of production systems are installed.

Broadly classified, the production lines consist of three lines such as transistor assembly lines, transistor array assembly lines, and hybrid IC assembly lines including the aluminum substrate production lines.

Each line is equipped with advanced wire bonding, mounting, coating, packaging machines. Each line has also divided assembly, inspection and final packaging divisions. The line configuration or distribution of production machines differ in characteristics by each manufacturer, so this plant has also installed its own developed and designed machines to establish the ideal production lines with cost reduction and no loss of productivity.

The new and advanced production concept called the SAFAlA (SANKEN Factory Automation & Information Analysis Systems) was applied in the plant, which aimed to establish a future production plant



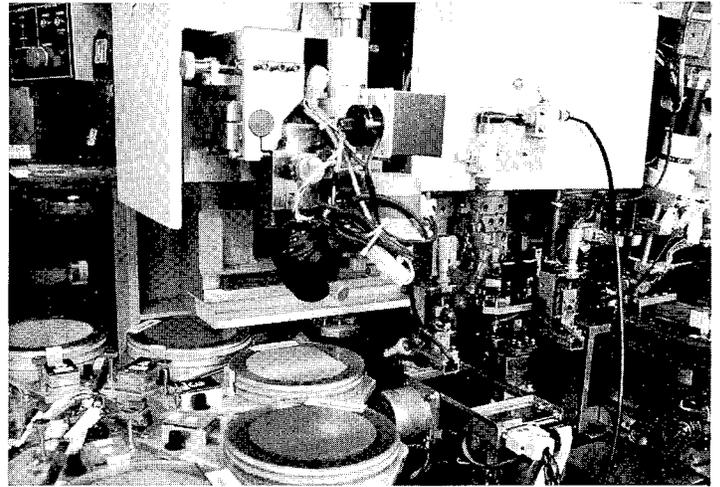
Wire bonding process for transistors



Diebonding & wire bonding process for transistors



*SAFAIA line for hybrid ICs*



*Die-mounters for transistor arrays*

with unsupervised and unmanned operation, and shorten the lead-time to about one fourth, and double the productivity compared with conventional modes at that time. This system was implemented and installed in Feb. 1993, and the first target was attained in Jan. 1994.

There are also some unique ideas for production machines which prevent the generation of losses or boost the productivity.

However, the most advanced division is the inspection division. There are various advanced and automated checking and inspection equipment, and furthermore visual inspection conducted by specialists.

At present, the installation of modern and advanced production systems in this field is normal to compete in the international markets. So, the production know-how using original production machines, and quality & performance checking and inspection setup has generated the difference with other manufacturers, which is vital in this industry.

The plant has coped well with the situation. As a result, the semiconductor products produced by this plant are highly evaluated by users worldwide, and have obtained and held a large share in the world market.

#### **(4) ISO and TPM Movement**

The plant received the ISO 9002 certifications in June, 1995, and at present the plant is preparing to receive the ISO 14001, and the plant has also involved the TPM (Total Product Maintenance) movement aggressively which aims to boost productivity, and will achieve new profits without product sales by reduction of total plant operation costs. These strategic movements of the factory will increase the competitive potential.

### **4. Uchiura Factory**

#### **(1) Outline of the Factory**

The factory is located near the top of the Noto Peninsula in the same prefecture, and faces Toyama Bay, but the distance from head office & Shika Factory takes more than 1 hour by car using the highway. It was constructed in April 1970.

The factory has 84,858 m<sup>2</sup> for land areas, and 14,850 m<sup>2</sup> for total building floor areas, and 398 employees.

The plant received the ISO 9002 certification in March 1996.

This factory was established as the plant for diode production only, and applied Sanken's unique mass-production systems to cope with the large demands worldwide. However, the factory faced increasing client demands which accompanied highly evaluation of quality and performance of diodes produced in this factory. So the company constructed new production system, called the ENP line, based on the a new concept. This line consists fully automated production machinery and equipment from raw material feeding, process inspection to continuous shipment inspection.

#### **(2) Products and Production Capacity**

The factory is an assembly plant for various types of diodes such as axial-type diodes, bridge-type diodes, and SMT diodes. The SMT diode is the newest type to cope with matching the needs for electronics and electric equipment manufacturer advanced assembly lines.

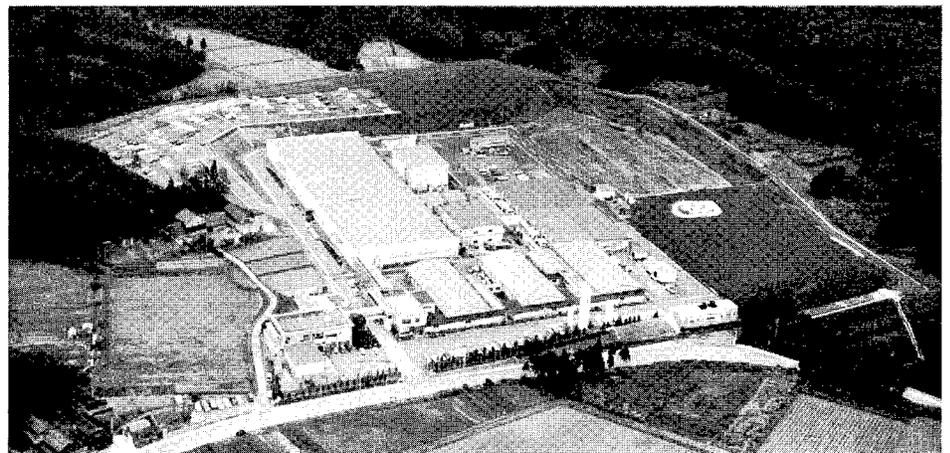
These products are used in the field of common power supplies, power supplies for telecommunications equipment, switching power supplies, high speed thyristors, and for temperature compensation.

The production capacity of the plant is 100 million units/month on average.

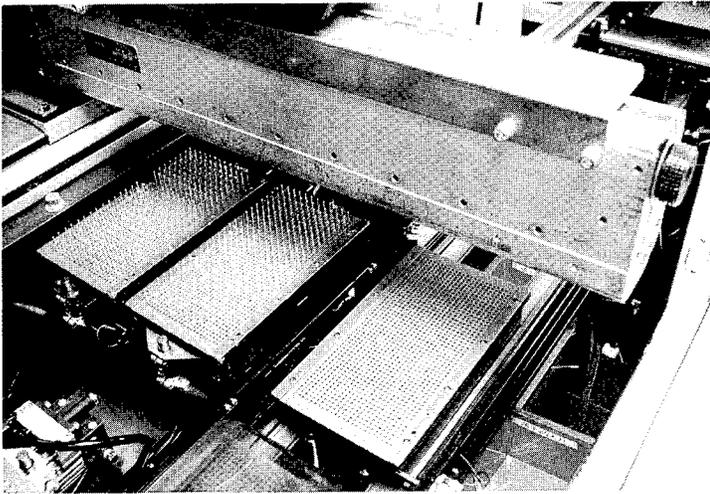
#### **(3) Production Lines**

The mass production line is adopted for production of various diodes, but easily copes with multi-type/small lot production. So the factory is enabled to produce various types of diodes classified by the performance, sizes, characteristics, etc. according to the user's specifications.

The newest diode production line is applied, and distributed as straight lines. However, it is difficult to attain the production of 100 million per month as ordi-



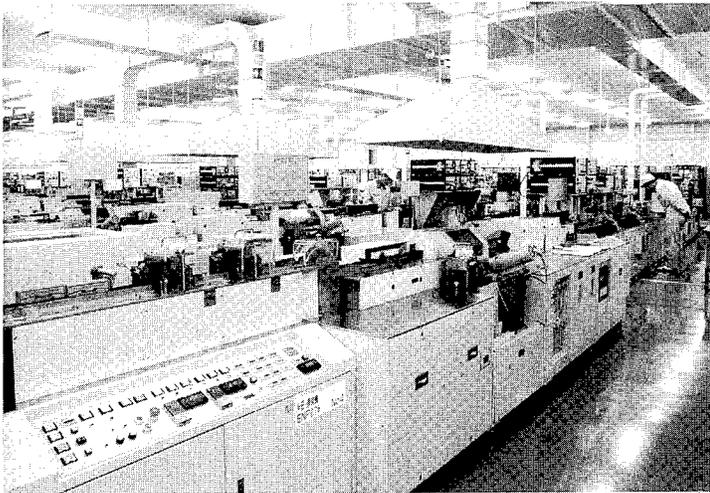
*Aerial view of Uchiura Factory for production of various types of diodes*



Lead-wire assembly process in the ENP line



Transfer mold process in the XD line



Checking & inspection process in the continuous straight ENP line



JCR process in the ENP line

nary production. So there are various unique and ideal systems developed and provided in the lines. Most outstanding are the jigs for arrangement of pin-type lead-wire of the diode, mini-assembly robots, package mould hardening furnaces, etc. Furthermore, there are separately installed assembly machines to bend and cut the length of the lead-wire of the packaged diodes automatically to cope with the user demands or specifications.

## 5. Shipment

Both Shika and Uchiura factories are basically responsible for producing the quality and high performance products, so the finished products are shipped to the distribution center of headquarters of Sanken Electric, and directly distributed by the sales division of the Sanken Electric to users worldwide.

## 5. Role of the Sanken Electric Headquarters

Sanken Electric Headquarters is located in Niiza City, Saitama Pref. and consists

of the Headquarters Semiconductor Technology Development Center (STDC) including business management, promotion, and production promotion divisions, two direct management factories of Niiza Plant with production of diode chips, including the Semiconductor Distribution Center (SDC) for shipment of products, and Kawagoe Factory for production of various power supplies such as switching, INV, uninterruptible, etc. and also conducts the R&D of such industrial products and their production technologies, both in Saitama Pref.

Accordingly, the headquarters has to procure raw materials both from its affiliates and outer sources, and provide the procured raw materials to Ishikawa Sanken Co. and other assembly affiliates, and procure the finished products produced by both factories. So the type of products and quantity for production are ordered by the headquarters.

However, the most important role of the headquarters is the R&D activities at the STDC to satisfy user requirements.

Sanken Electric has developed new products and epoch-making products in the past, and is now conducting research in the electronics and electric fields.

The production technology of both Shika and Uchiura factories is based on the STDC's achievements.

But, these two factories have well established production know-how independently, which are the strong points both for Sanken Electric and Ishikawa Sanken due to the boost in the productivity.

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# TOPICS

*This section describes selected developments of special importance or interest due to the achievement of a breakthrough or innovation in technology.*

## ***Innovative High-Efficiency Rotating Machines Based on Improved Dynamics Analysis***

Newstein Lab., Inc. has developed a new type of high-efficiency rotating machine with less gas exhaustion, lower cost, reduced machine strength requirements, less heat generation and lower weight that utilize a variety of reciprocating engines, turbines, electric motors and the likes equipped with at least one such rotating body.

Dynamics is an area in which most mechanical engineers are puzzled and confused, particularly in the dynamics analysis of the rotational motion. The basis of the new machines is based on prior art technology by reforming the shape and the mass distribution of the rotating body to reduce or eliminate the internal inertial force, which is an centrifugal force caused by the rotation.

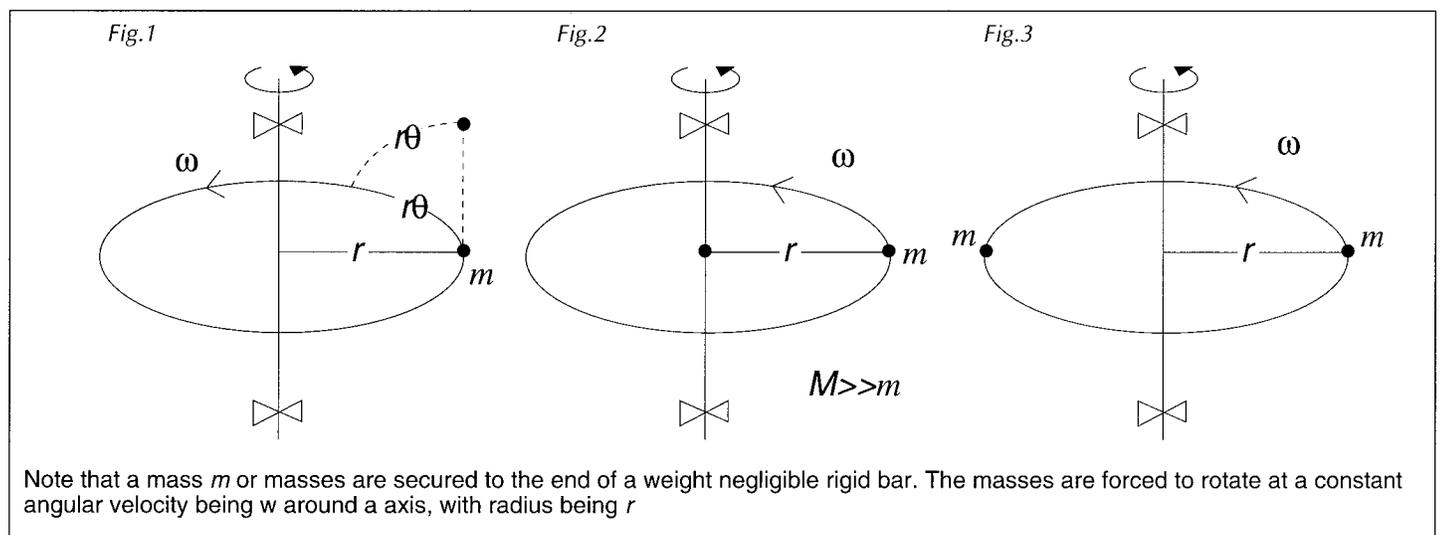
The following diagrams show examples of the new technology. Fig.1 shows a centripetal force (centrifugal force), equal in direction of the displacement, acting on the mass observed at the coordinates af-

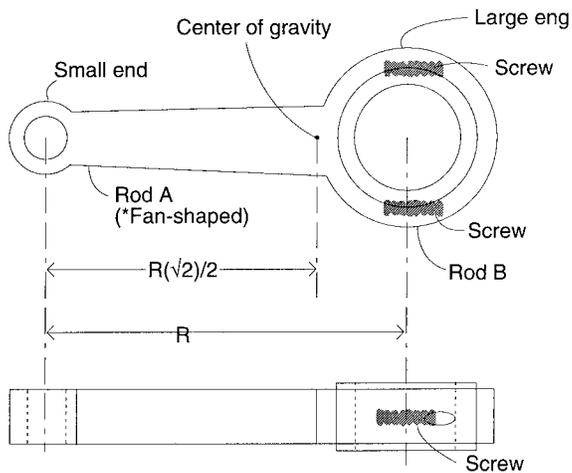
fixed to the mass. The power consumption being  $L=mr^2\omega^3t$  is defined as the total amount of work done. In this case, the circular motion of the mass at a constant rate requires the power supply of  $p=mr^2\omega^3$  in the total time  $t$ . Fig.2 indicates an artificial satellite orbiting around the earth. The satellite requires no power supply for the circular motion after the satellite has entered stationary orbit because the center of gravity is substantially located at the center of the mass  $M$ . In this case, therefore, the satellite virtually conserves its angular momentum. Fig.3 shows an example of a well balanced child toy top which keeps rotating for a long period. The system of two masses conserves its angular momentum because the system of the two masses rotates as if the total mass of the system is concentrated at the center of gravity (rotational axis) based upon dynamics. In this case, the pair of centripetal forces cancel each other. Fig.4 shows a practical type of connecting rod with the

principal axis of inertia essentially matching the center of gravity by eliminating forces exerted on the crankshaft. Fig.5 shows the new crankshaft in contrast to the prior art in that the section of the crank arm and balancing weight are fan-shaped to eliminate the cause of power loss. The overall rate of practical fuel consumption is expected to be about one third of an engine using the prior art technology.

Another example is a turbine with a shroud-ring which creates a very efficient and enclosed axial-flow type turbine for high-speed turbines, compressors, fans, rotor blades, and rotor vanes in axial-flow blowers. The design is achieved by essentially eliminating the action of the inertial force when the turbine rotates at high speed.

In a turbine with a shroud-ring according to the prior art, the shroud-ring absorbs the action of the inertial force and becomes deformed or damaged. The overall rate of practical fuel consumption can be





Note: A principal axis of inertia essentially matching the center of gravity.

Fig.4

expected to achieve a 40 to 50% improvement ratio compared to a turbine based on prior art technology.

This new type of technology is a considerable departure from the traditional design considerations, and has been patented in the USA, #5,650,684, Rotating Body and Machines Incorporating Same and patents are pending in Japan, Korea and Europe.

\* *Newstein Lab., Inc.*

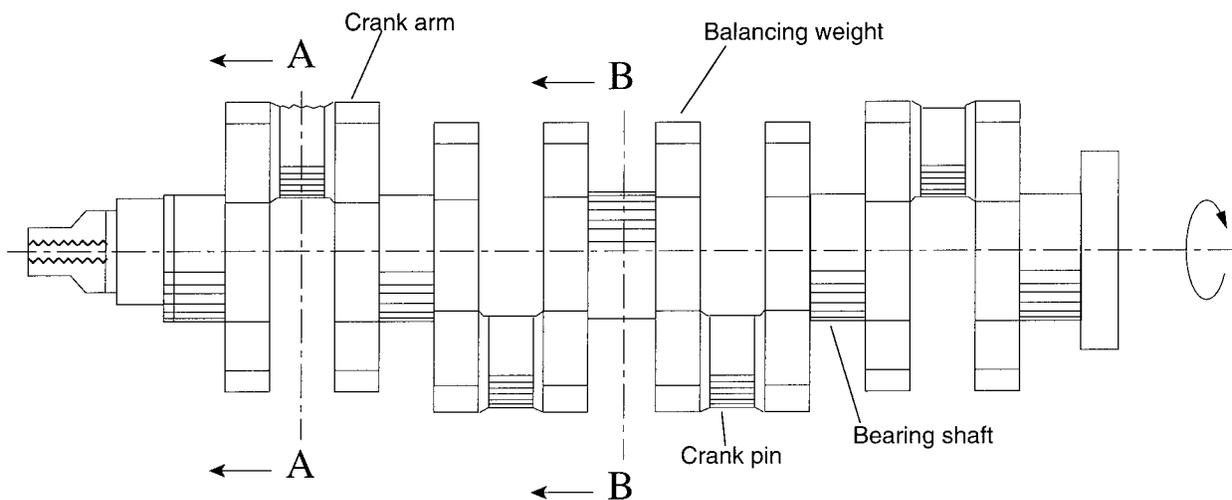
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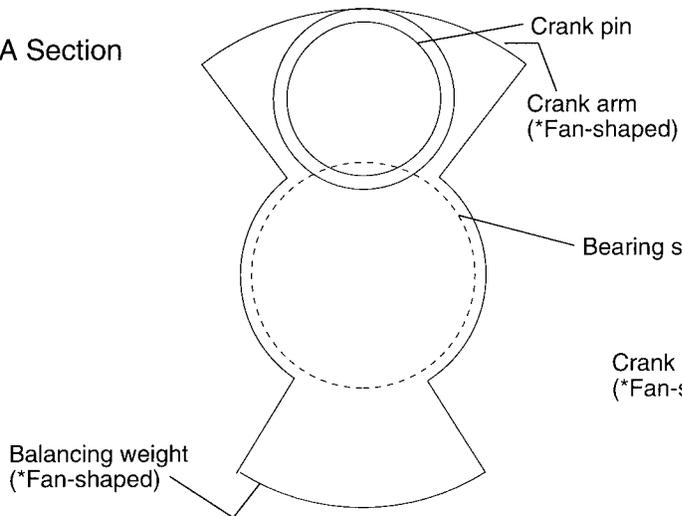
Fax: +81-45-253-0370

Fig.5 (Crankshaft for multi-cylinder reciprocating engine)

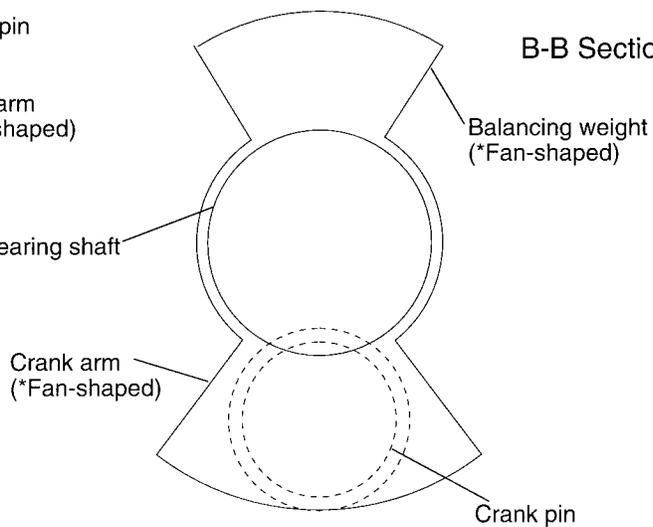


Note: All made of materials having the same density

A-A Section



B-B Section



# NATIONAL R&D PROJECTS

*This section describes various R&D projects being carried out in Japan on a national scale.*

*\* Agency of Industrial Science and Technology, MITI  
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## *National Research and Development Programs for Medical and Welfare Equipment*

### **Outline of R&D Programs**

Japanese society is presently undergoing aging at a pace never experienced before by any country in the world. In concert with the advent of the aged society, diversified social changes are foreseen, such as changes in health structures, changes in health consciousness, pursuit of worthwhile living, desire of healthy aged citizens to participate actively in social activities, promotion of self-sufficiency by aged and disabled persons with reduced physical capability, and a growing need to alleviate care burdens.

To cope with these themes, the National Research Program to Develop Medical and Welfare Equipment (called Industrial Science and Technology Research and Development Program from 1993) was established to research and develop safe, highly convenient and moderately priced medical

and welfare equipment by applying advanced industrial technologies with the close cooperation of the industrial, academical and governmental circles.

### **Setup of R&D Programs**

R&D programs are implemented by the New Energy and Industrial Technology Development Organization (NEDO) with funds disbursed by the Agency of Industrial Science and Technology of the Ministry of International Trade and Industry by consigning these research and development projects to private enterprises, as well as by the various institutes belonging to the Agency of Industrial Science and Technology. (See Fig. 1.)

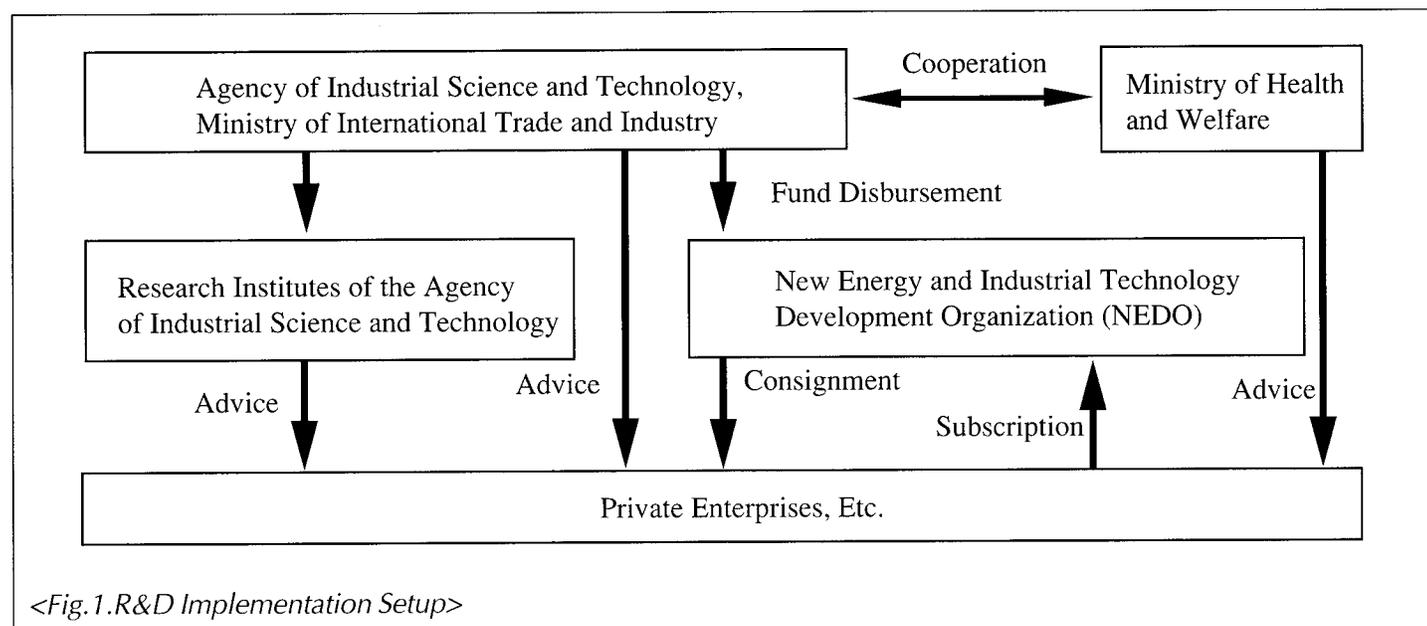
### **R&D Projects**

Subsequent to the implementation of these R&D Projects concerned in 1976, 39 themes have already been completed as of

the end of FY 1997 and 71 themes are presently in progress as of FY 1998 (refer to Fig. 2).

### **1. Blood Microsampling/Microanalysis Systems Development Projects (Preventive and Examination Sector)**

Systems will be developed which permit highly accurate and early diagnosis, or which enable biological samples such as the blood to be extracted in minute quantities by shallow invasion for the most rapid and detailed analysis of various pathological information appearing in the form of changes in the cells, genes and other indices in the extracted biological samples. In concert with the progress in related research and development, it will become possible to extract deeper microsamples by shallower invasion to enable precision analysis with ever smaller quantities of samples.



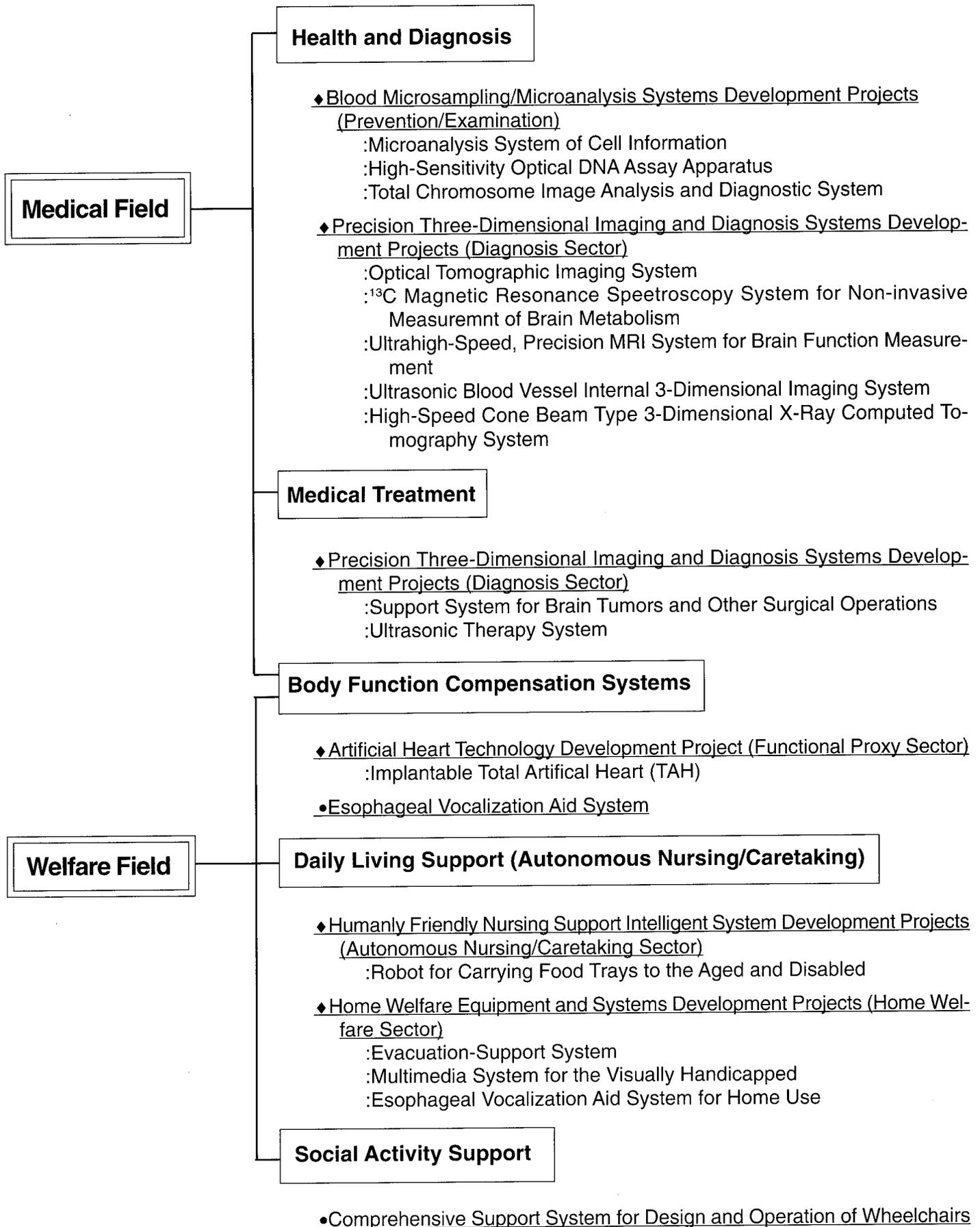
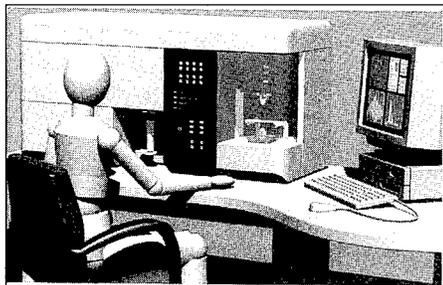


Fig. 2 Projects under development

### 1) Microanalysis System of Cell Information

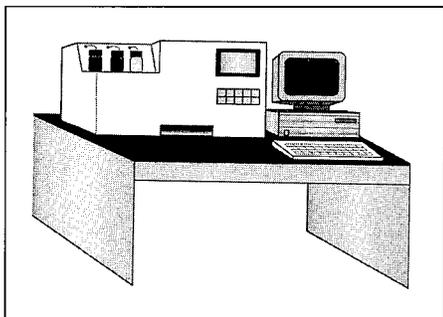
A system for early diagnosis is under development by which the molecular and cellular morphological changes (image information) of surface and internal tissues are detected immediately after infection by using blood and tissue microsamples (FY 1995-2000).



Conceptual drawing of the completed system

### 2) High-Sensitivity Optical DNA Assay Apparatus

Under development is an optically safe, highly sensitive automatic examination system in which specific DNA and RNA are fixed onto pathological viruses on a silicon monocrystalline wafer to analyze the state of infection and thickness of related cell membranes (FY 1995-1999).



Conceptual drawing of the completed system

### 3) Total Chromosome Image Analysis and Diagnostic System

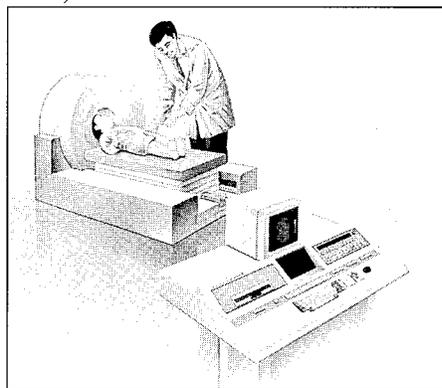
A system will be developed that is an application of advanced genome engineering, laser engineering and the image analysis technology to permit the identification of the increase/decrease of specific chromosomes associated with diseases such as cancer to permit early prediction, diagnosis and prevention of these diseases. (FY1999-2012).

## 2. Projects to Develop Precision Three-Dimensional Imaging and Diagnosis Systems (Diagnosis Sector)

For the realization of accurate early diagnosis and advanced surgical support, advanced, high-functional and innovative measurement techniques will be developed while monitoring the progress in related research and development, to enable biological measurements utilizing low-frequency magnetic field, ultrasonic wave, radio wave, microwave, infrared ray, visible ray, X-ray, gamma ray and others, and to assess biological morphological information and functions information most accurately to permit imaging in real time.

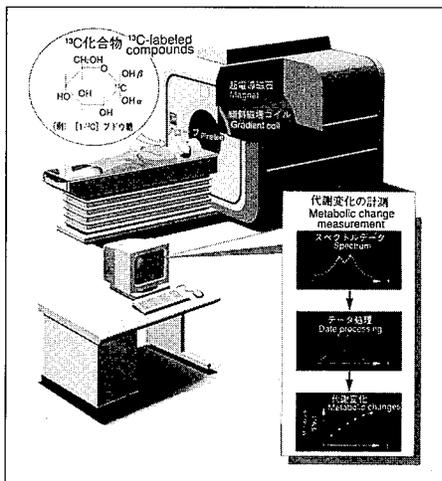
### 1) Optical Tomographic Imaging System

Under development is a system that utilizes near infrared light beams to measure the quantities of light permeating through or scattered inside living bodies, to acquire tomographic images of the distributions of oxygen and enzymes for diagnosis of tissue metabolism and circulatory system diseases (FY 1992-2008).



Conceptual drawing of the completed system

### 2) <sup>13</sup>C Magnetic Resonance Spectroscopic System for Non-Invasive Measurement of Brain Metabolism

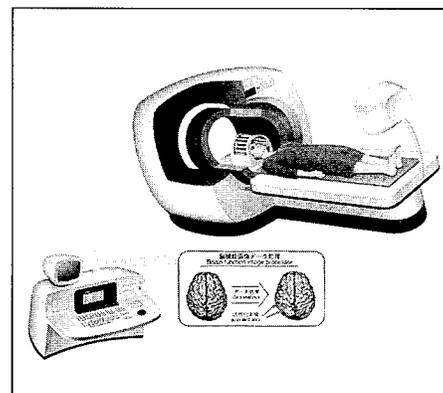


Conceptual drawing of the completed system

Compounds containing the stable isotope (<sup>13</sup>C) will be injected to probe into the behaviors of the most vital carbon chain compounds in biological metabolism, for the non-invasive measurements of the process of metabolism in the brain (FY 1994-1998).

### 3) Ultrahigh-Speed/High-Precision MRI System for Brain Function Measurement

In order to safely and accurately diagnose the states of activities of the brain various parts, research will be advanced to develop a system incorporating high-speed photography, various types of stimulation generation technologies and signal analysis technology based on the high-performance gradient magnetic field generation technology (FY 1995-1999).



Conceptual drawing of the completed system

### 4) Ultrasonic Blood Vessel Internal 3-Dimensional Imaging System

To permit high-speed, high-accuracy three-dimensional diagnosis of the inside and peripheral parts of blood vessels without exposure to radiation, research will be advanced on ultrasonic imaging inside blood vessels with a catheter type polymer ultrasonic probe, and a system for ultrasonic catheter navigation (FY 1998-2011).

### 5) High-Speed Cone Beam Type 3-Dimensional X-Ray Computed Tomography System

Research will be advanced to develop an X-ray computed tomographic system that will permit highly accurate three-dimensional diagnosis of a wide range of the breast ailments (FY 1998-1011). (to be continued next issue)

# GENERIC TECHNOLOGY REVIEW

## Research on Oxide Semiconductor Optoelectronics

## Bionics: Study of the mechanism of information control in neural cell systems

This section describes various basic research and development activities in Japan to inform the world about generic R&D efforts here.

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### Research on Oxide Semiconductor Optoelectronics

*Electrotechnical Laboratory*

#### Research Objectives:

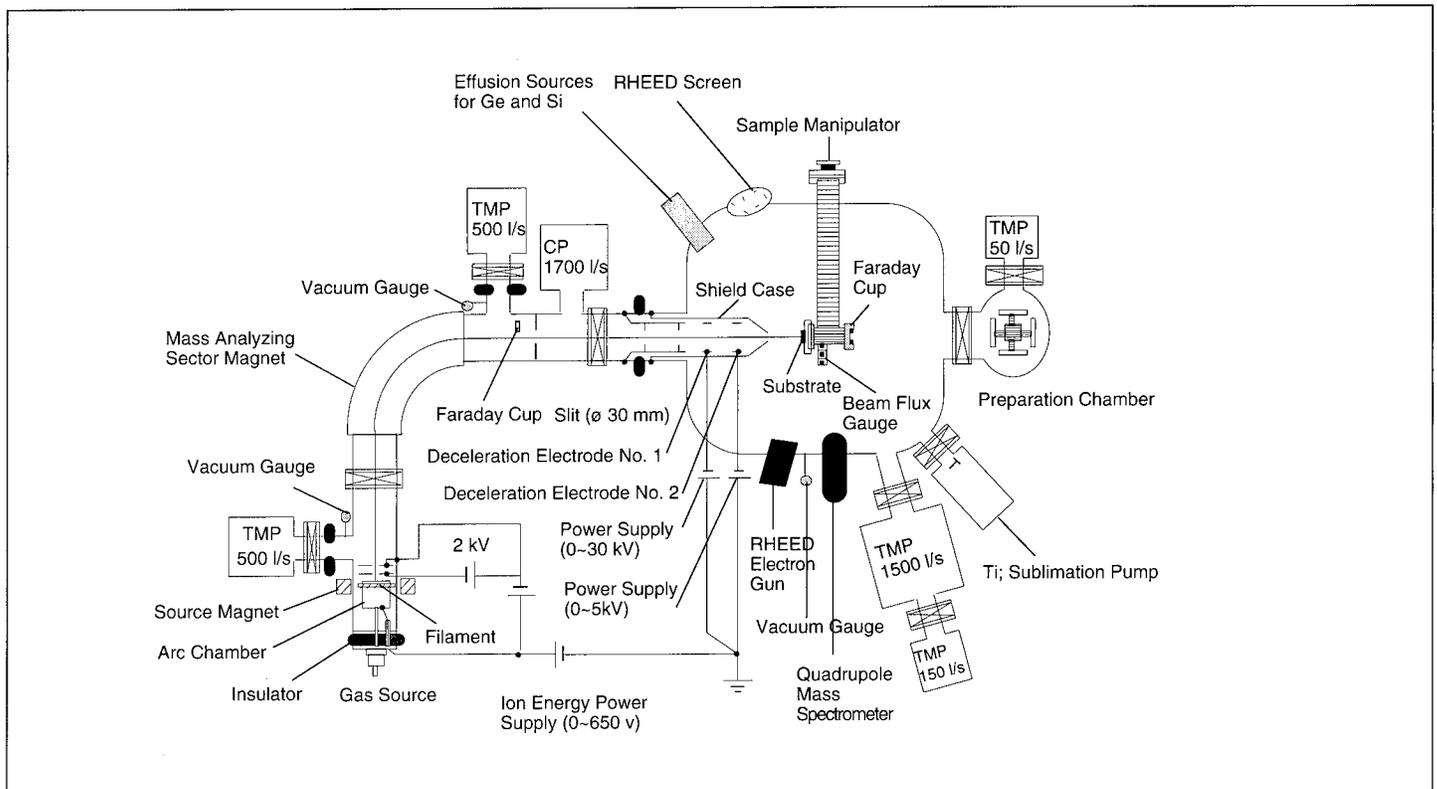
In this project, we aim to develop a new approach to optoelectronics based upon oxide thin films. Using epitaxial growth techniques as well as novel material process technologies, we intend to develop new functional optoelectronic devices with optimal optical and electrical properties.

#### Research Content:

Film growth is achieved by means of a Si molecular beam and use of an extremely low energy O ion beam simultaneously incident upon the substrate. Use of the low energy O ion beam allows direct control and use of the metastable oxidation process for the deposition of SiO<sub>2</sub> thin films with a high degree of crystallinity. This research represents a unique and novel approach to the epitaxial deposition process of SiO<sub>2</sub> on a Si substrate.

#### Historical Background:

Recent reports indicate that strong spontaneous light emission occurs in nanostructural modified group IV semiconductors such as Si. These reports suggest that there exist still not well understood mechanisms for light emission in indirect bandgap materials. If Si based light emitting devices can be fabricated by harnessing this newly observed phenomena, Si-based, monolithic devices which integrate both optical and electrical functionality can be used in combination with already well established Si ULSI technology to realize a powerful new paradigm.



**Bionics: Study of the mechanism of information control in neural cell systems**

*Electrotechnical Laboratory*

Goal: Natural organisms or biological systems have an excellent ability to adapt to environments. We try to find a hidden information processing algorithm of the nerve system for the adaptation, and pave a way to a new field of infomatics. To do this in a simplified manner, we will break down the problem into several levels of complexity of the biological system from a molecule in a single cell to the most complex form of a biological system including the elaborate neural network and investigate how neural systems at each level widespread under cooperation and control with each other.

**Approach:**

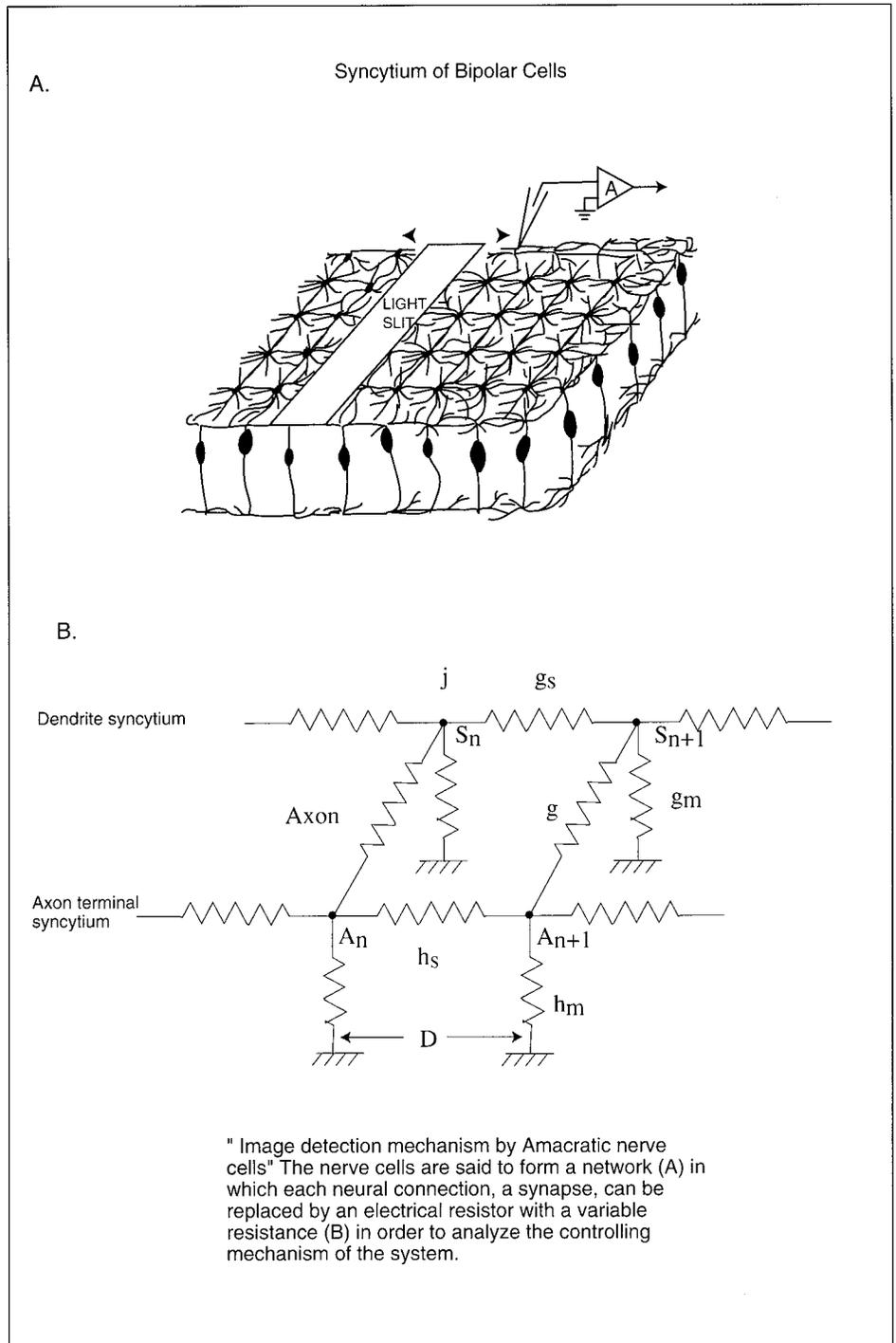
1. "Image detection mechanism by Amacritic nerve cells" Amacritic nerve cells are in the retina where the real image of input light is focused in an eye ball. We are searching for the mechanism through which they can detect the images by analyzing the function of a key substance, nitrogen mono-oxide (NO), which may activate the vision system. The nerve cells are said to form a network in which each neural connection, a synapse, can be replaced by an electrical resistor with a variable resistance in order to analyze the controlling mechanism of the system in terms of, for instance, the resolution of an eye. We try to study this neural circuit by analysis of the response to a computer-controlled optical impulse using a medicinal stimulant such as NO.

2. "Differentiation of Neurons during Newt Retinal Regeneration" Adult newt can regenerate a fully functional retina after removal of whole retina. Upon removal of retina, pigment epithelial cells dedifferentiate into retinal precursor cells that proliferate and differentiate into all kinds of retinal cells. One of the important aspects of this functional differentiation is the specific expression of ion channels specific to the different kinds of neuron. We will try to study when, where, and how the differentiation takes place by watching the activation of the ion channels as a marker, which detetmines the electrical nature of the nerve cell. The research will clarify so-called switch which triggers the

functional differentiation even of a cell that does not differentiate for itself and we hope that the research result will be applicable even to a brain damage of vertebrates including human beings which is impossible to recover at present medical treatment.

3. "Study of Molecular System for Neural and Channel Activation Mechanism" We will carry out crystallization of Ca channel and Na channel proteins which have a function to selectively pass each ion through a cell membrane and are inevitable

for the information processing in a neural system as functional molecules, and also search for a specific genome activated as a result of neural action. The detailed study of the structure of such proteins are not easy in a living cell and they need to be extracted and crystallized in a certain amount. The research will eventually clarify the channel controlling mechanism as well as the molecular mechanism of information processing at a synapses communication that will be the basis for the modelling of a molecular system for the neural and channel activation mechanism.



98-04-100-01

### Amplification of Stratified Tunnel Type Magnetoresistance Effect with Pressure

The Joint Research Center for Atom Technology (JRCAT) has discovered that the stratified tunnel type magnetoresistance effect of stratified perovskite oxides consisting of lanthanum (La), strontium (Sr), manganese (Mn) and oxygen (O) can be amplified further by a pressure.

The research team earlier succeeded in manifesting the stratified tunnel type magnetoresistance effect in a weak magnetic field by using a stratified manganese oxide  $\text{La}_{2-2x}\text{Sr}_{1+2x}\text{Mn}_2\text{O}_7$  ( $x = 0.3$ ). The present research project may be regarded as the follow-up project. The research team discovered that the magnetoresistance effect is amplified by about ten times by a pressure on the substance.

Fig. 1 shows the crystal structure of  $\text{La}_{2-2x}\text{Sr}_{1+2x}\text{Mn}_2\text{O}_7$  and its high-resolution electron microscope image. A study of this structure shows that the crystal is a

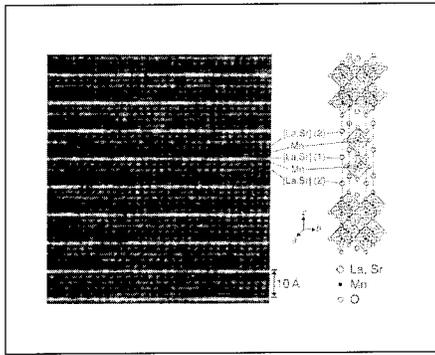


Fig. 1 Crystal structure of  $\text{La}_{2-2x}\text{Sr}_{1+2x}\text{Mn}_2\text{O}_7$  ( $x = 0.3$ ) (right) and high-resolution electron microscope image (left)

multistrata membrane consisting of lamination of two layers of  $\text{MnO}_2$  displaying a ferromagnetic metallic property and a block layer of nonmagnetic insulation ( $\text{La, Sr})_2\text{O}_7$ . The stratified manganese oxide crystal structure apparently includes a ferromagnetic/nonmagnetic stratified structure that was synthesized only as an artificial lattice previously (more accurately, a ferromagnetic tunnel junction of infinite stratified structure since there is a lamination of ferromagnetic metal and nonmagnetic insulation).

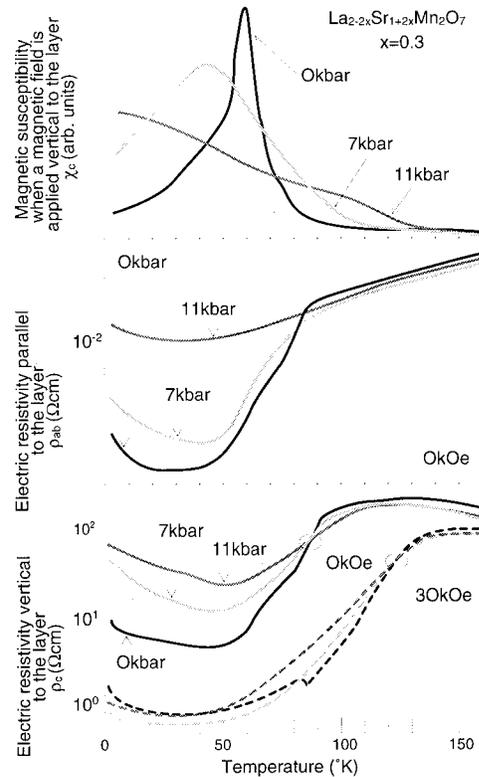


Fig. 2 Temperature dependence of the magnetic susceptibility  $\chi_c$  (top), and of the electrical resistivity ( $\rho_{ab}$ ,  $\rho_c$ )

### Pressure-enhanced MR in $\text{La}_{2-2x}\text{Sr}_{1+2x}\text{Mn}_2\text{O}_7$ , $x=0.3$

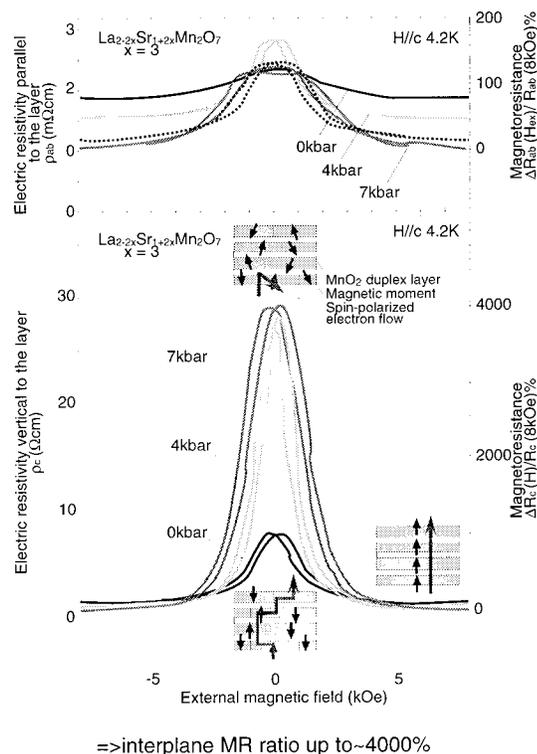


Fig. 3 Magnetic field dependence of  $\rho_{ab}$  and  $\rho_c$  (bottom) at 4.2K, in the magnetic order phase

=>interplane MR ratio up to ~4000%

The  $\text{La}_{2-2x}\text{Sr}_{1+2x}\text{Mn}_2\text{O}_7$  ( $x=0.3$ ) monocystal was formed by the floating zone melting process. Fig. 2 shows the temperature dependence of the magnetic susceptibility  $\chi_c$  (top), and of the electrical resistivity ( $\rho_{ab}$ ,  $\rho_c$ ) when a  $\text{MnO}_2$  duplex layer was impressed with a magnetic field in parallel (middle) and orthogonally (bottom), under various pressures [0 (room pressure), 7 and 11 kbar (kilobars)]. The 0 kbar data indicate that a sharp maximum value of the magnetic susceptibility is observed at near 60 K. The sharpness gradually decreases as the pressure is increased and also shifts toward a lower temperature. This suggests, in connection with the 0 kbar, that a stratified anti-ferromagnetic magnetic order is formed at near 60 K, but that this magnetic order is weakened with increasing pressure. However, detailed research relating to the magnetic order will further be necessary through neutron beam refraction experiments, which is presently in progress. The results of the electric resistances in a nonmagnetic field [0 kOe] show that in the low-temperature domain, that may be assumed as a magnetic order phase, the values of  $\rho_{ab}$  and  $\rho_c$  are both increased by about 10 times in concert with an increase in the pressure. However, in a magnetic field (30 kOe),  $\rho_c$  is retained at a fixed value without being influenced by the pressure.

Based on these observations, the effects of the pressure and magnetic field on the magnetic susceptibility and electric resistance are explained as follows. Fig. 3 shows the magnetic field dependence of  $\rho_{ab}$  (top) and  $\rho_c$  (bottom) at 4.2 K that is the magnetic order phase. Here,  $r_c$  corresponds to the direct measurement of the conductance characteristic of the intrinsic ferromagnetic tunnel junction. Firstly, attention is focussed on the results obtained at room pressure (0 kbar). When the magnetic field is intensified from zero magnetic field, the value of  $\rho_c$  decreases rapidly in the low magnetic field domain, and in the magnetic field of over the saturation field ( $H_{\text{sat}} \sim 4$  kOe), the value remains on a generally fixed level. The magnetoresistance ratio  $\rho_c(H_{\text{sat}})/\rho_c(0)$  here is estimated at a few hundred percent.

This enormous magnetoresistance is conceived to be due to the following causes of changes in the magnetic structure. In a magnetic field higher than the saturation field, all Mn site spins are faced in the di-

rection of the magnetic field and bonded in ferromagnetic form. In a nonmagnetic field, the Mn side spins in the duplex layer are bonded in ferromagnetic form, but the  $\text{MnO}_2$  duplex layer spins become anti-ferromagnetic in a certain domain, while in some other domain, they bond ferromagnetically (refer to the diagrams shown in Fig. 3). In this case, for the spin-polarized electrons to shift (tunnel) into the adjacent  $\text{MnO}_2$  duplex layer, they will have to pass through the ferromagnetically bonded layer. Therefore, the resistance will be greater than when a magnetic field is applied so that a tremendous stratified tunnel type magnetoresistance effect is generated. This indicates that a phenomenon similar to the tremendous magnetoresistance effect observed in an artificial lattice system has been realized in a stratified substance.

This magnetic structure is changed by applying a pressure. As shown in Fig. 3,  $\rho_c$  is increased considerably by a pressure of about 7 kbar in a nonmagnetic field. This increase in  $\rho_c$  is conceived to be due to the weakening of the  $\text{MnO}_2$  duplex layer magnetic bonding by the pressure. The pressure not only suppresses the interlayer nonmagnetic bonding but also weakens the ferromagnetic bonding by action of the conductance course, so that  $\rho_c$  is increased (see the inserted diagrams shown in Fig. 3). Therefore, impressing a magnetic field and recovering the interlayer magnetic bonding will decrease the  $\rho_c$  value to a level almost equivalent to that of  $r_c$  at room pressure. The magnetoresistance ratio  $\rho_c(H_{\text{sat}})/\rho_c(0)$  is estimated at about 4,000% under pressure. This enormous tunnel type magnetoresistance effect is closely related to the fact that perovskite type manganese oxide is completely spin-polarized by about 100% (for example, 11% in case of the transition metal Ni). This enormous spin polarization is one of the characteristics of perovskite type manganese oxide, and conceived to be due to the very strong bonding between spin and charge ( $J_H \sim 2$  eV) based on the Hund rule.

The considerable increase in the stratified tunnel type magnetoresistance effect by pressure described above is a phenomenon based on a stratified substance built into a crystal structure consisting of a ferromagnetic tunnel junction. This research program was advanced by applying a hydrostatic pressure, but it may become pos-

sible to convert electric signals by growing a thin film of this substance on a wafer made of a piezo-electric material, for example, and changing the pressure.

The increased tunnel type magnetoresistance effect observed through this research project is a distinct advantage for decreasing the intensity of the dynamic magnetic field that is obstructing the commercialization of manganese oxides. The working temperature and other conditions still remain to be resolved, but an enormous magnetoresistance increase effect is displayed that is far greater than that of conventional types of transition metals

\* *Joint Research Center for Atom Technology (JRCAT)*

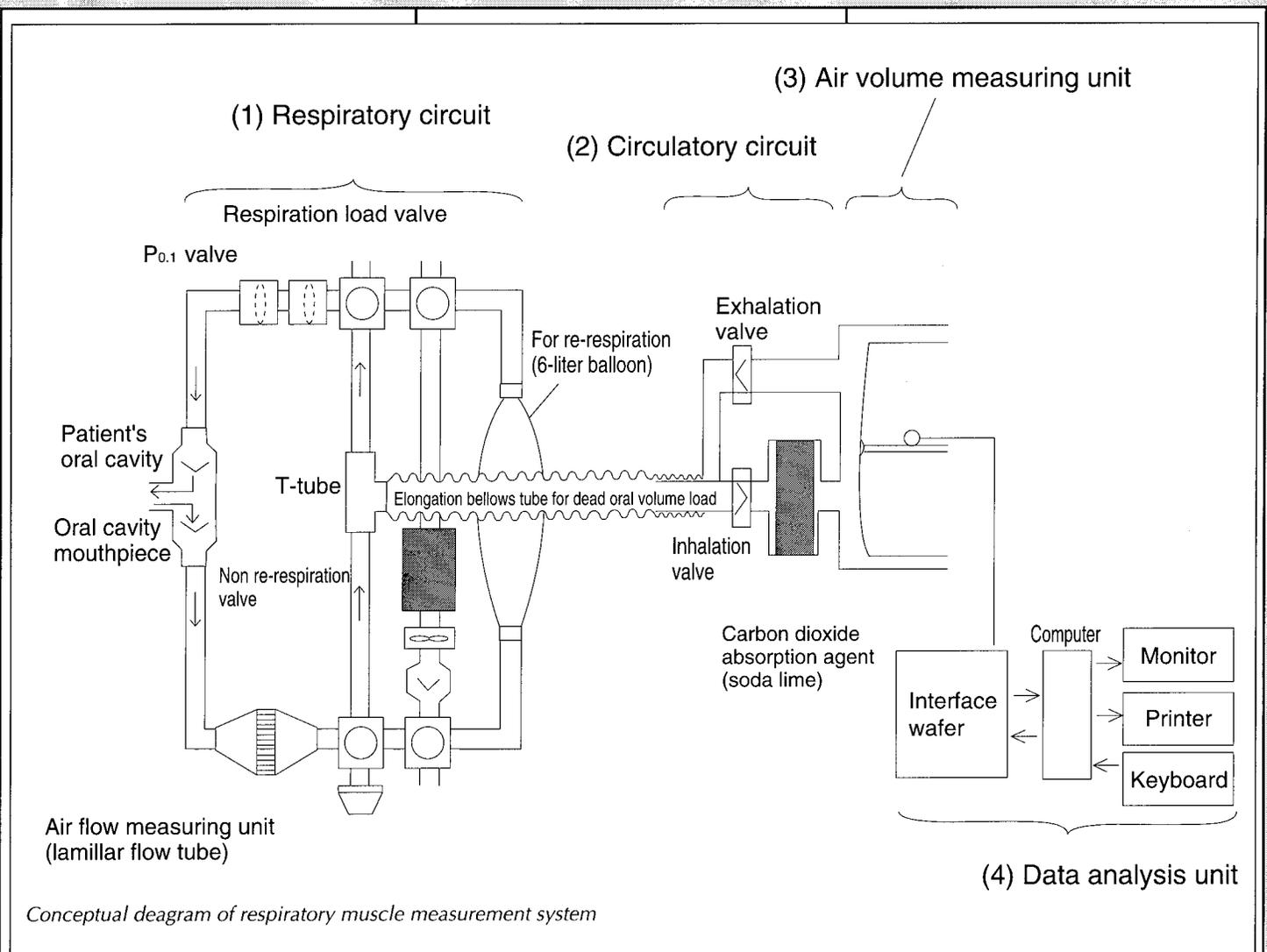
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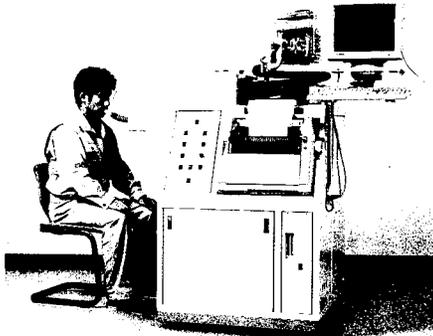
### **Respiration Muscle Function Measurement System Developed Successfully**

Japan Science and Technology Corporation and Chest Co., Ltd. have jointly developed a respiration muscle function measurement system. With this system, a bellows type tube connected to the patient's oral cavity is extended at a fixed speed to increase the inside volume of the respiratory circuit. This, in turn, increases the respiratory dead oral volume and continuously increases the patient ventilation (air exchange) volume, so the increment in the respiratory muscle oxygen consumption volume can be calculated, by which the system is usable for measuring the changes in the respiratory efficiency caused by any functional abnormality of the respiratory muscle.

The system consists of a respiratory circuit, circulation circuit, air volume measuring unit and data analysis unit (see accompanying diagram), which display the following functions. The respiratory circuit consists of a bellows type tube with intermediate part wound on a rotary drum. One terminal is connected to the respiratory circuit, and the other terminal connected to the circulatory circuit. Revolving the drum elongates the bellows type tube and increases its inside volume continuously, by which the load on the respi-



Conceptual diagram of respiratory muscle measurement system



Respiration Muscle Function Measurement System

respiratory muscle is increased. The circulatory circuit has the function of adsorbing and removing, by action of the adsorption agent (soda lime), the carbon dioxide contained in the patient's exhalation induced by the respiratory circuit. The air volume measuring unit is connected to the circulatory circuit and removes the

adsorbed carbon dioxide and measures, with each breathing operation, the change in the air volume arising from the volumetric change of the respiratory circuit. The data analysis unit consists of a CPU and CRT, and computes the changes in the respiratory muscle oxygen consumption volume with respect to the increase in the ventilation (air exchange) volume from the data supplied by the air volume measuring unit, and displays and records the results.

The system is usable as an examination and diagnosis system for the diagnosis of the functional abnormalities of the respiratory muscle as well as for assessing therapeutic effects. This system performs oxygen consumption rate measurements of the respiratory muscle when the dead oral volume is increased continuously, and incorporates a mechanism for optionally setting the respiration environment (setting the carbon dioxide density

or oxygen density as well as the air passage resistance of the respiration circuit). Therefore, the system is effective for the diagnosis of functional abnormalities of the respiration muscle as well as for judging therapeutic effects. Since the sense of respiration difficulty is related to the oxygen consumption rate, it is usable for obtaining indices on the degrees of respiration difficulty, as well as in the sectors of sports medicine and for the treatment of elderly patients.

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# NEW TECHNOLOGY & PRODUCTS

This section provides information about recently developed technologies and products, divided into Advanced Materials, Electronics & Optics, Information & Communications, Process & Production Engineering, Construction & Transportation, Energy, Environment, and Biotechnology & Medical Science.

## Advanced Materials

### 98-04-001-01 Biodegradable Polylactic Acid Fiber

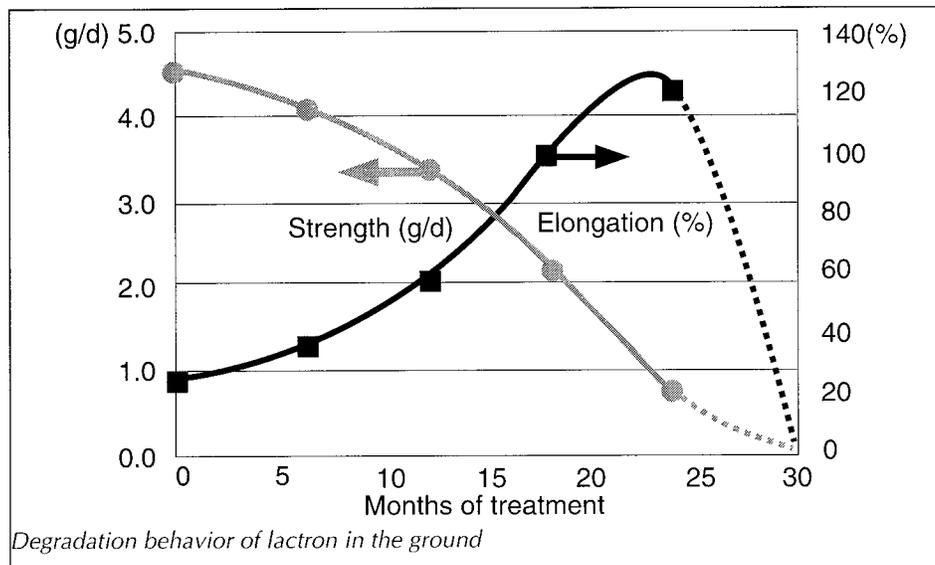
Kanebo Gohsen Ltd. has developed a polylactic acid fiber Lactron that uses lactic acid obtained from starch, such as that obtained from corn, and is a completely recyclable and biodegradable synthetic fiber (polylactic acid fiber).

The company has devised various applications for the fiber, and tested the fiber for biodegradation properties by burial in the ground, and treatment with the seawater immersion process and the activated sludge treatment process. In the ground burial process, there was no change in the fiber weight, but the strength was virtually lost entirely in 8-10 months and the fiber was actually confirmed to have been decomposed completely. Similar results were confirmed through the seawater immersion

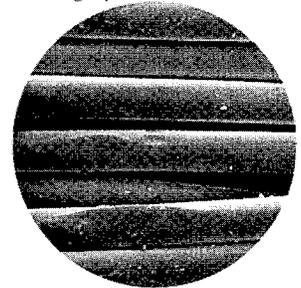
test. In the activated sludge treatment process, the fiber was decomposed rapidly by the action of the bacteria and microorganisms in the sludge. The fiber lost strength almost completely in 1-2 months, and biodegradation tests conducted by a standard composting process (office workstation process = OWS process) showed extremely rapid and complete biodegradation, faster than the degradation of cellulose.

Conventional types of synthetic fibers such as the polyester fiber withstand degradation and retain the original shape and characteristics when tested with these treatment processes, but cellulose-based fibers such as those made of cotton and rayon undergo faster degradation than polylactic acid fiber in activated sludge.

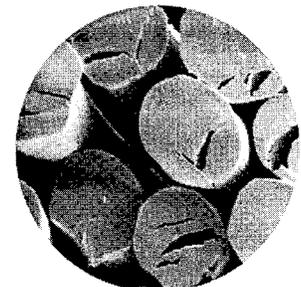
Lactron uses no chemical raw material, so when disposed of after use will decompose readily into carbon dioxide and water



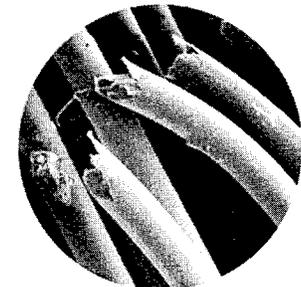
# SEM Photographs



Before degradation



2.5 months after treatment with activated sludge



3 months after treatment with activated sludge

by action of the microorganisms in the ground or sea water, so there is no pollution of the global environment. The raw material is starch, with a regeneration cycle as short as 1-2 years, so the volume of carbon dioxide gas is reduced in the atmosphere by the photosynthesis action of the corn used to make the fiber.

Lactron, when composted in the same manner as garbage with a public or industrial treatment facility, is decomposed completely and safely into carbon dioxide gas and water. Also, when incinerated, no NOx is generated in the combustion gas, and since the combustion heat is about one-third that of polyethylene or polypropylene, the incineration furnace is not damaged. Lactron features the highest melting point of the biodegradable fibers developed, and can be used in various fiber modes such as multifilament, monofilament, staple fiber and spun-bonded fiber, and since it possesses adequate initial-stage strength, is ideal for use in the manufacture of various types of industrial materials and fabrics in general.

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98-04-001-02

### Color Filter-Less Liquid Crystal

Bright Lab. Co., Ltd. has succeeded in driving a TN liquid crystal display in full color without using a color filter. This is an application of a unique high-speed liquid crystal drive technology, and the drive has been demonstrated with a thin film transistor (TFT) liquid crystal. The company plans to introduce a TFT liquid crystal demonstration model in May this year and to

gain the cooperation of panel manufacturers in further developing TN and TFT mode liquid crystal products not using a color filter.

In experiments, success was achieved by using the field sequential display system (time division type color display system). With this system, the background light is in the three primary colors of red, green and blue, with the three colors switched at a high speed of 1/180th of a second. Due to the eye residual image characteristic, the red, blue and green colors are observed in a mixture and appear as a full color, and there is no flicker.

The time division concept was known from before, but there had been no high-speed liquid crystal drive technology. The research team changed the drive waveform of the circuit that drives the liquid crystal, by which the liquid crystal display speed was increased by over ten times compared with before.

Upon the commercialization of a color filter-less liquid crystal, it will become unnecessary to use a color filter while the number of driver ICs necessary for the segment driver will be reduced to one-third, so that system cost reduction of about 30% will become possible.

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in this outer space environment because, in this environment, the ambient temperature varies greatly from cryogenic temperature to extremely high temperature, depending on how the sunlight is irradiated on the planet.

In such an environment, the semiconductors used in existing computers will become inoperative. Even if semiconductors made of silicon carbide (SiC) capable of withstanding high temperatures were used, the working range will be limited to about 600 °C. Josephson devices utilizing superconductivity work even in cryogenic environments. However, judged from their mechanism of operation, they are unlikely to operate at temperatures over room temperature, so this new optical device capable of working in the temperature range from cryogenic to extremely high temperatures will have a big influence on space technology development. If it became possible to apply and utilize this device characteristic of working at high temperatures to environments other than the outer space, then the device will become applicable to various industrial fields. For example, by mounting a device (controller) directly on an automobile engine part of high working temperature, it will become possible to control the engine itself.

Another distinct characteristic of this optical device is that it is an all-optical device working at superlow power. It will operate at a minimum of a few dozen nW/cm<sup>2</sup>, a power level that is more than ten digits less than that of an existing device based on the nonlinear optical effect. Also, since this new device displays a negative light input/output property, it can be used to comprise an optical NOT (inverter) circuit that is indispensable for a theoretical optical circuit, and a basic optical computer device could be designed for controlling the entire range of optical signals by using optical signals. Upon the realization of an optical computer with superparallel arithmetic function, it will become possible to anticipate the emergence of computers displaying performances which are definitely higher than existing electronic computers.

Fig. 1 shows a conceptual diagram of a measurement system, and Fig. 2 (a) and (b) the waveforms of light transmitted through a device heated to 1,050 °C and the incident light, respectively. The waveform of

## Electronics & Optics

98-04-002-01

### Optical Device Workable in Temperature Range from -260 to 1,100 °C

Yoshinobu Maeda of Toyota Technological Institute has developed an optical device that can operate in the temperature range from -260 to 1,100 °C. The device was developed by using a substance featuring the negative nonlinear absorption effect (Maeda Effect) displaying the negative light input/output characteristic.

Specifically, the optical transition characteristic of erbium (Er), a rare earth element, is utilized. The device uses the optical transition of the inner shell of the er-

bium atom, so is little influenced by the ambient temperature and can operate in a very wide temperature range. Experiments have confirmed that the device is workable in a broad temperature range from -260 °C to 1,100 °C, this means that the device can work within the temperature range from cryogenic temperature to an intensely high temperature.

Humanity is destined to explore outer space in the coming 21st century, and people may be able to live on planets other than the earth. Here, one of the most serious problems is that the computer used widely on the earth today cannot be used

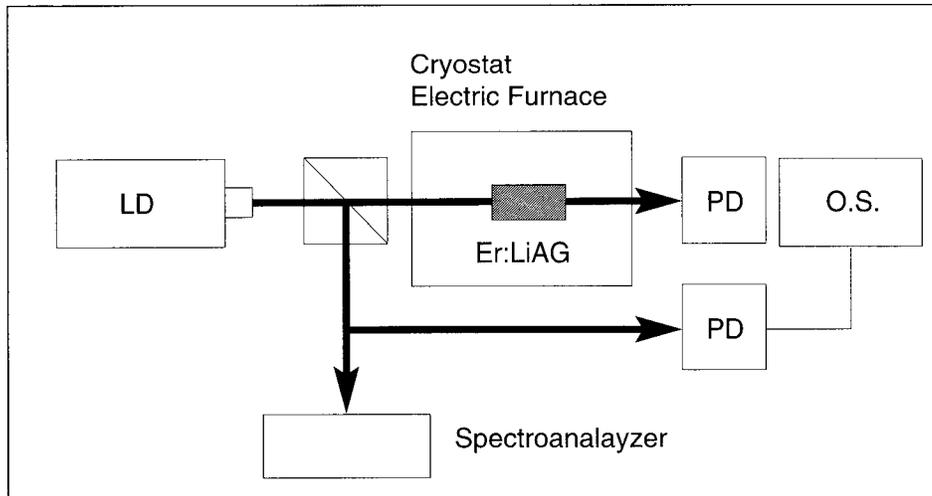


Fig. 1. Conceptual diagram of measurement system

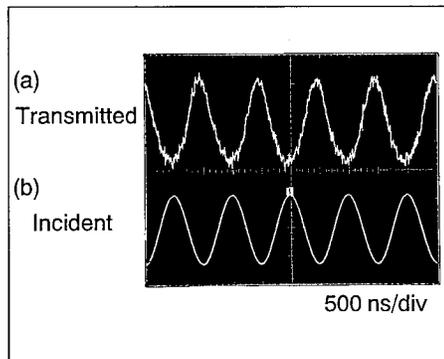


Fig. 2 Waveforms of transmitted and incident light beams

the transmitted light is inverted with respect to the waveform of the incident light, indicating that the device is acting as an optical signal inverter. Upon the commercialization of this inverter, it will become possible to fabricate an entire series of theoretical digital optical circuits. Further, this phenomenon has been confirmed to occur at an extremely low level of power of minimum 60 nW/cm<sup>2</sup>, and is responsive down to frequencies of 1 GHz (switching speed of 10<sup>-9</sup> s).

With this device, the erbium element acts as an optical device, so the device can be fabricated by doping erbium into various types of substances such as crystals and glass. Therefore, devices of various substances and shapes can be made.

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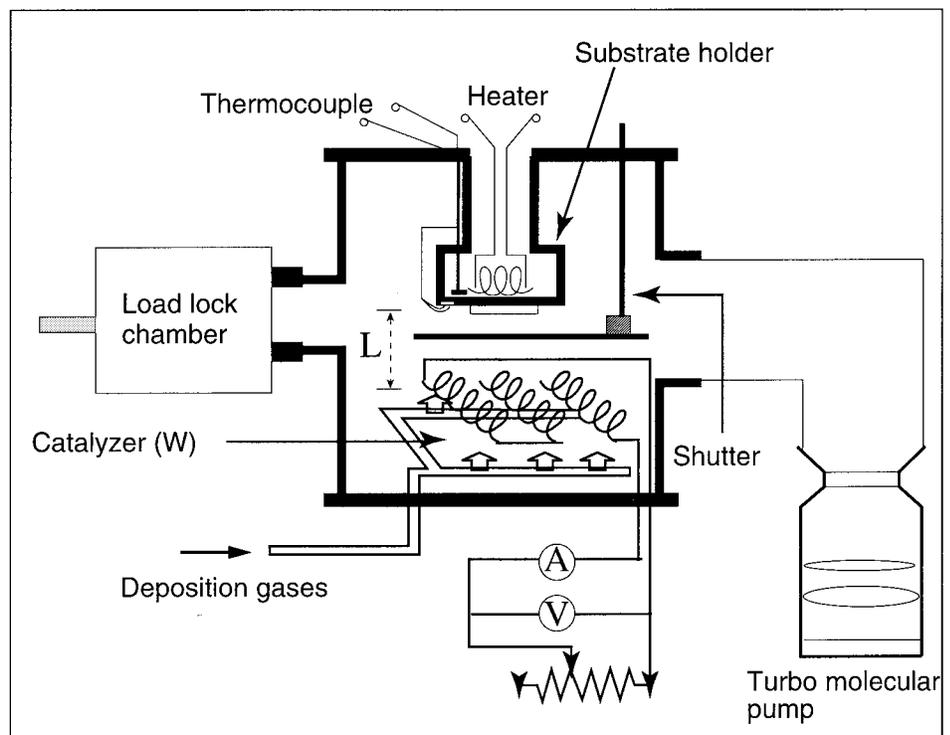
98-4-002-02

**New Catalytic Chemical Vapor Deposition Technique for Polycrystalline Silicon Film Deposition onto Glass Substrates**

Prof. Hideki Matsumura of the Japan Advanced Institute of Science and Technology (JAIST) has established a technology that permits thin electronic material films to be deposited onto substrates of large areas at a low temperature without using plasma, and has named the technology the Catalytic Chemical Vapor Deposition (CAT-CVD) process.

By applying this technology, polycrystalline silicon films were successfully deposited directly onto glass substrates. The polycrystalline silicon film is anticipated for application as a thin film transistor (TFT) material for driving liquid crystal displays (LCDs). So far, amorphous silicon has been employed as the TFT material, but amorphous silicon has a relatively small mobility and a delay in signal propagation occurs as the display size becomes increasingly larger, making the use of a display larger than 30 inches impractical. The polycrystalline silicon features a large mobility and enables the fabrication of displays larger than 60 inches, and since the aperture ratio is also improved, it will become possible to fabricate bright displays.

The most common method of preparing polycrystalline silicon films is crystallization by laser annealing, but its throughput is rather poor and unsuitable for working with large substrates. By applying the Cat-CVD process, a tungsten wire used as the catalyzer is heated to 1,500-2,000 °C in a growth chamber, and polycrystalline silicon films can be formed with ease simply by introducing silane gas and hydrogen gas on the catalyzer, and simply increasing the covering area of the tungsten wire enables the film forming area to be large.



Design of catalytic CVD

Also, the glass used as the substrate of the polycrystalline silicon film lacks the necessary heat resistance, and the temperature cannot be raised beyond 600 °C, but with the Cat-CVD process, the catalyzer temperature and the substrate temperature can be controlled independently to enable polycrystalline silicon films to be formed even at substrate temperatures as low as about 400 °C. In addition, the hydrogen in the polycrystalline silicon film due to material gas decomposition generally impair the stability of film characteristics, but with the new Cat-CVD process, the hydrogen content in the polycrystalline films was discovered to be reduced to about one-tenth compared with the conventional process, which stands out as another distinct advantage.

The Japan Science and Technology Corporation consigned the work of commercializing this Cat-CVD film forming system for polycrystalline silicon film to ANELVA Corp., a manufacturer of semiconductor manufacturing systems, which plans to commercialize the system within three years.

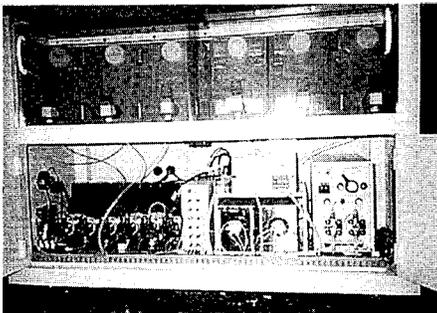
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98-04-002-03

### Automatic Ultramicroanalysis System for Silica

Ihara Physical and Chemical Research Laboratories Co., Ltd. and Oki Electric Miyagi Co., Ltd. with guidance from Dr. Takao Yotsuyanagi of the Department of Applied Chemistry, Faculty of Engineering, Tohoku University, have jointly developed an Automatic Ultramicroanalysis System for Silica, KEISER-100 to measure the



Automatic ultramicroanalysis system for silica

ultratrace quantities of silica in ultrapure water indispensable for the manufacture of integrated circuits(ICs).

This ion pair adsorption-elution technique now enables ultratrace quantities of silica to be concentrated by about 1,000 times compared with before. In the process of producing ultrapure water for use in IC washing, tap water is first treated in a factory, in which case the water is packed into an aluminum pack to coagulate and settle impurities by primary treatment. Next, the water is passed through several stages of reverse osmosis membrane systems, further through an ion exchange resin system, to remove molecules and ions successively from large to small particles.

However, even pure water prepared in this manner still contains silica in the form of silicate ions which have eluded the resin-based filtration system, so when the water is used in IC manufacture, these molecules and ions react with metal ions in the washing water and are adhered onto ICs in the form of ultrafine impurities. The new measurement system uses ammonium molybdate to react with silicate ion forming these substances. The silicamolybdate heteropolyacid (water-soluble) is then reacted with tetraethylammonium bromide (paired ion) to obtain a water-insoluble ion-pair.

The ion-pair is further collected onto a concentration column packed with an absorbing agent, and 1 ml of organic solvent is added into the column. The ion pairs are dissolved, and the light absorption of the solution containing the ion pair is measured at a wavelength of 810 nm. The solvent used is 1 ml for 1 liter of the sample solution, so the concentration will be 1,000 times. The system is operated entirely with a pumping system.

However, molybdenum iso-polyacid is generated at the same time in the silicate-molybdate reaction, and this possibly causes the background for the measured value. To obtain the accurate results by eliminating the molybdenum iso-polyacid, the company replaced the contents inside the concentration column with a special type of substance. The choice of this new adsorbing agent is the key to performing accurate measurements.

The removal of silica residue not only improves the IC yield but also prevents

deterioration of the boiler heat exchange efficiency. At present, the ion exchange resin has to be replaced regularly in conformance with the degree of silica adhesion, but the establishment of the accurate measurement system to assess the degree of silica adhesion will enable the interval of the replacement to be prolonged, and contribute to the system cost reduction.

The removal of silica present as an impurity in water is an urgent matter to be resolved in the face of increasing large-scale integration of semiconductor devices. The system is marketed at a domestic price of ¥12 million.

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98-04-002-04

### Autosensing 10/100 Switches for Desktop Connectivity

Cisco Systems, Inc. of California has announced the Cisco Catalyst 2900 Series XL, a new family of high-performance autosensing 10/100 Fast Ethernet desktop switches with various port densities, configuration options and pricing to meet a wide range of network design requirements.

The Catalyst 2900 Series XL switch family delivers wire-speed performance, versatile modularity and easy-to-use Web-based management with four models and two expansion modules. With full support for Cisco IOS™ software, the new family of switches provides superior functionality for end-to-end integration, including bandwidth aggregation, networked multimedia support and future virtual LAN (VLAN) support.

The new Cisco Catalyst 2900 Series XL switches expand the Cisco Catalyst switch line to provide the most comprehensive set of end-to-end switching solutions from the desktop to the central-site data center. This family of auto-sensing 10/100 switches provides a scalable, highly manageable solution that provides customers with flexible desktop connectivity accompanied by wire-speed performance.

The Catalyst 2900 Series XL switches are based on an advanced architecture that offers a 3.0 million packet-per-second for-

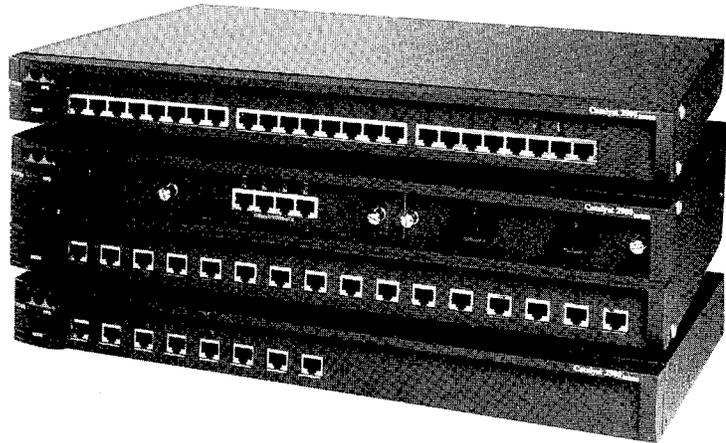
## NEW TECHNOLOGY & PRODUCTS

warding rate and a 1.6 Gbps forwarding bandwidth to deliver wire-speed performance for up to 16 ports in full-duplex operation. Bandwidth aggregation through Fast EtherChannel technology enhances fault tolerance and offers up to 800 Mbps of bandwidth between switches, routers and individual servers. Autosensing on all ports ensures that each connection is served at its optimal 10/100, full-duplex capability, without management intervention or reconfiguration. Cisco Group Management Protocol (CGMP) reduces overall network traffic by enabling a switch to forward routed IP multicast selectively and dynamically to targeted multimedia desktop users.

Versatile module slots provide low-cost expansion capabilities, higher-speed connectivity and support for future interface and feature modules, allowing the flexibility to upgrade networks with new features, technologies and functionality at the desired pace.

The switches are managed through a Web-based interface that monitoring of the switch from anywhere on the network through a standard browser. CiscoWorks network management software provides a common management interface for all Cisco hubs, routers and switches on the network. In addition, the switches also support the traditional Cisco Command Line Interface (CLI) management and standard SNMP. An autoconfiguration feature eases deployment by automatically configuring multiple switches across a network from a single boot server. An embedded Remote Monitoring (RMON) software agent provides enhanced traffic management, monitoring and analysis.

The eight-port Catalyst 2908 XL switch is ideal for aggregating smaller Ethernet and Fast Ethernet workgroups and servers. The Catalyst 2916M XL switch offers 16 ports and two versatile module slots. In addition to being an excellent aggregation device, the 2916M XL is also tailored to provide dedicated 10- or 100-Mbps bandwidth to individual users. For workgroups, the 24-port Catalyst 2924 XL and 2924C XL switches are ideal for delivering low-cost, high-performance 10- or 100-Mbps bandwidth to individual users and servers. For high-speed connectivity over extended distances, the Catalyst 2924C XL switch



Catalyst 2900

offers 22 10BaseT/100BaseTX ports and two 100BaseFX ports.

Two expansion modules for the Catalyst 2916M XL, a four-port 10BaseT/100BaseTX switch module and a two-port 100BaseFX switch module, allow easy increase of port density and higher-speed uplinks through bandwidth aggregation. Future Gigabit Ethernet, ATM and ISL VLAN modules will enable users to upgrade the network backbone and enhance the functionality of the switch.

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98-04-002-05

### Ultraprecision Positioning System for Manufacturing Disks

NTN Corporation has developed a nanometer-scale ultraprecision positioning system (table) that is extremely resistant

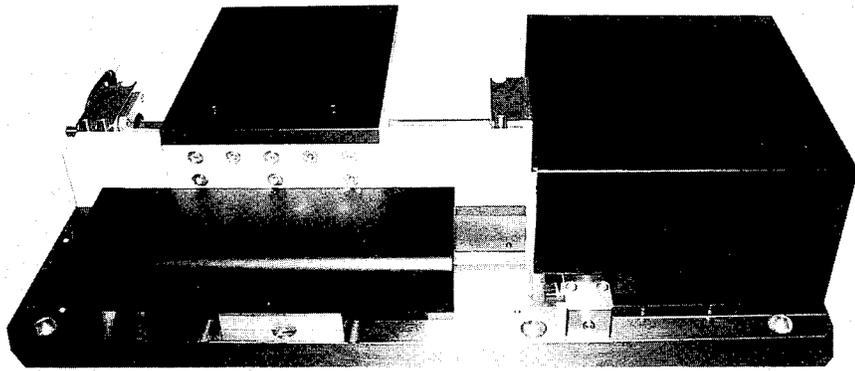
to external disturbances caused by air current flows and floor vibrations, and which enables ultraprecision positioning in the process of disk manufacture.

Recently, various types of optical disks have been produced with increasing ultraprecision, such as compact disks (CDs) with a track pitch of 1.6  $\mu\text{m}$ , digital video disks (DVDs) with a track pitch of 0.74  $\mu\text{m}$  and next-generation high-density disks with a track pitch of 0.3-0.4  $\mu\text{m}$ . To permit the fabrication of these disks with such ultraprecision, the introduction of a special type of vibration-proof positioning system and working environment is indispensable to eliminate even the slightest vibrations caused by air current flows and floor vibrations.

The newly developed positioning system combines a ceramic high-rigidity air slide and friction drive system of unique structures, by which the smoothest drive

#### System Specifications

Stroke	: 180 mm
Straightness, horizontal	: 0.2 $\mu\text{m}$
vertical	: 0.2 $\mu\text{m}$
Resolution	: 2.7 nm
Repetitive positioning accuracy	: $\pm 2.7$ nm (by feedback scale)
Loading capacity	: 200 N
Rigidity	: 100 N / $\mu\text{m}$
Air consumption rate	: 20 N $\ell$ / min
Mass	: 110 kg
Guide system/material	: Hybrid of magnetic force and static pressure, / ceramic
Drive system	: AC servomotor (friction decelerator + rotary friction screw)
Control system	: Fully closed loop control with linear scale



Ultraprecision positioning system for manufacturing disks

and positioning accuracy of  $\pm 2.7$  nm have been realized to enable ultraprecision nanometer scale positioning. This new system meets the ever stringent positioning accuracy required not only for manufacturing various types of disks with ultraprecision track pitches but also for manufacturing various types of advanced

ultraprecision semiconductors and inspection systems.

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der, by which the volume of the pruned off vegetation can be reduced to about one-seventh, and the fine chips converted into compost, mulching material, horse and cow stable bedding material, bamboo grass carpet and others. A built-in blower fan permits the chips to be loaded onto a truck or sprayed directly into a shrubbery or plantation ground with a hose 7 m long. The chipper also incorporates a variety of safety devices, including an emergency stop pushbutton, a safety lock, engine start control unit and a safety lock for use when working the chip feeding rollers. In addition, a control panel is provided to improve the system operability and which does not impair the field of vision of the workers.

Due to the development of this wood chipper, there is no need to convey the pruned out vegetation, fallen leaves and cut miscellaneous grass outside a park or greenery region as in the past, and it can be treated at the site for conversion into some useful material or for recycling in the form of compost, so the labor and time for transporting the pruned out vegetation outside are conserved substantially.

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 Fax: +81-545-53-3456

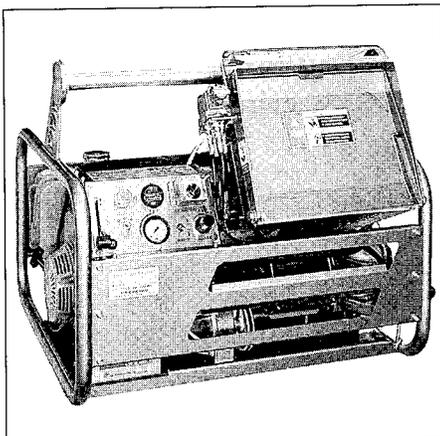
## Machinery & Mechatronics

98-04-003-01

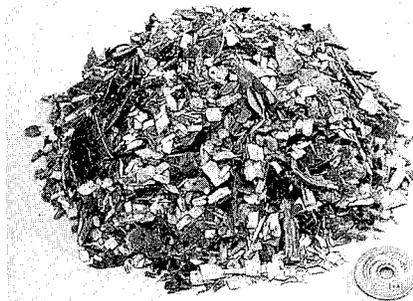
### High-Performance Wood Chipper

Matsumoto Industry Co., Ltd. has developed a high-performance wood chipper Super Shredder, KF-150A that is used when engaging in tree pruning.

This wood chipper measures about 1 m on all sides and has a total weight of 290 kg, or is compact and lightweight, and can



High-performance wood chipper



Chipped products

be mounted on a light-duty truck or crawler carrier with ease for conveyance to the worksite. A new type of feed system is introduced, by which the treatment capacity is comparable to that of a large chipper. Tree trunks with diameters of up to 15 cm can be chipped at a rate of 3 m<sup>3</sup>/hr, and branches with leaves and bamboo grass at a rate of 2 m<sup>3</sup>/hr.

The wood chipper is equipped with a drum cutter and a unique high-speed shred-

98-4-003-02

### Water Conservation Device Not Changing Water Pressure

S. E. Soken Co., Ltd. has marketed a water conservation device Mizu Irazu that enables water to be conserved by over 50% without changing the water pressure. Simply setting the grooved top-shaped water conservation device inside the faucet causes the tap water peripheral flow to become denser and the central flow to become thinner to permit water conservation.

Normally, the curved lines provided inside the faucet cause the tap water to flow along these lines, so the water volumes in the tap water peripheral part and in the central part are the same. In contrast, the water conservation device, which is provided with grooves by precision machining, causes an eddy current in the tap water, so that the water flow will be less on the inside than on the outside of the water stream, but to the human eye, the water flow will appear the same as before.

The device causes the water to flow in an eddy current. The water density is less further inside the flow, but the water flow appears the same as before.

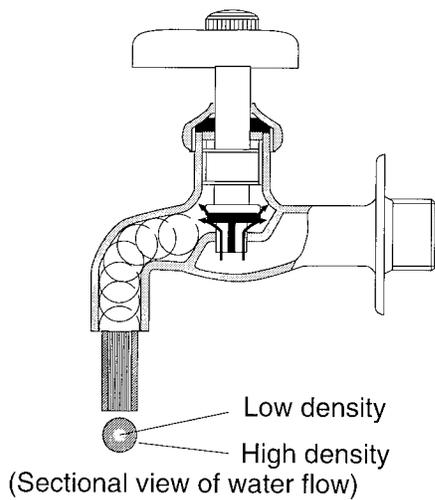


Fig.1 Water flow mechanism using the apparatus

The water flows in conformance with the faucet curve, and the densities of the water at the peripheral and central parts will be the same.

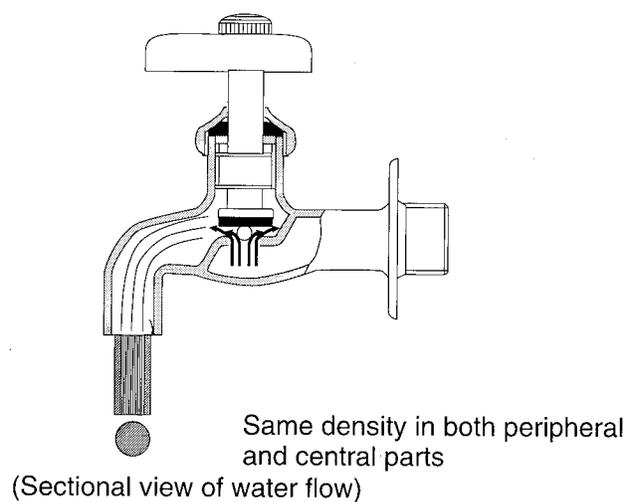
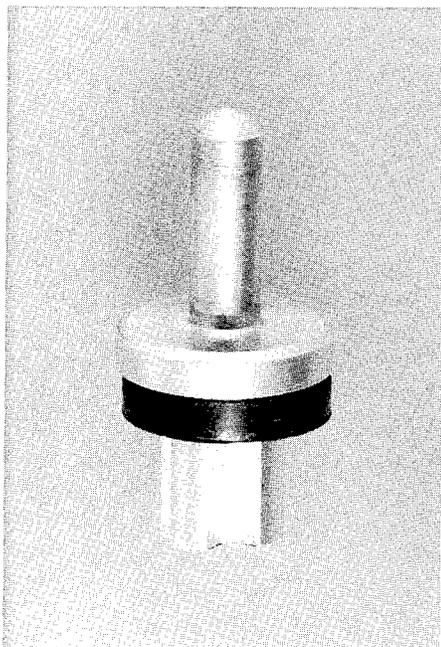


Fig.2 Water flow mechanism without using the apparatus



Water Conservation Device Not Changing Water Pressure

With the conventional type of water conservation device, decreasing the water volume will make the water flow thinner and the user will consider the flow of water inadequate. The new device prevents the user from sensing the water conservation effect even when the water is conserved by about 50%, and there is also the advantage that the water is not splashed up, and that there

will be no water pressure difference in the upper and lower floors of buildings.

The device uses rubber with a thermal resistance of 150 °C, so it can be installed to replace the water stop cocks in shower systems and high-tech faucets displaying temperature adjustment functions to enable substantial water conservation. The device is designed primarily for commercial use by buildings and restaurants, and since it is available at a moderate initial cost and enables substantial water conservation, the capital cost can be depreciated in a short period of time.

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98-04-003-03

## Oil Fogging System for Machining Tools

TACO Co., Ltd. and Toyota Industrial Co., Ltd. have jointly developed a semi-dry machining oil fogging system available in the MCA Series (see accompanying photo) that is intended to improve the machining environment.

This system uses compressed air to generate an oil fog (mist) with particle diameters of micron size to release small quan-

tities of cutting oil to cutting tools such as drills, taps, reamers, tools and millers as well as to the inside parts of cutting tools and to the outer parts of cutting spots to improve lubrication and heat suppression.

Compared with the conventional type of coolant system, the machining accuracy is improved, the deterioration of the machined face prevented, the life expectancies of tools prolonged, and the disposal of waste oil and fluids facilitated, while the removal of chips and other adhesions from the machine and its surrounding parts with a detergent is accomplished easier, so that the working environment is improved considerably. Due to semi-dry machining, the chips are generated in a virtually dry state to permit recycling intact without requiring removal of fluid.

Compared with the completely dry machining method that uses no oil agent, heat generation is suppressed by lubrication, which enables high-speed, efficient grinding, so that the machining accuracy is improved and the life expectancies of the grinding tools prolonged substantially.

The MCA Series fogging systems constantly supply a fixed volume of oil mist of fine particle diameter regardless of the size or number of grinding tools which are used. Since these systems are designed

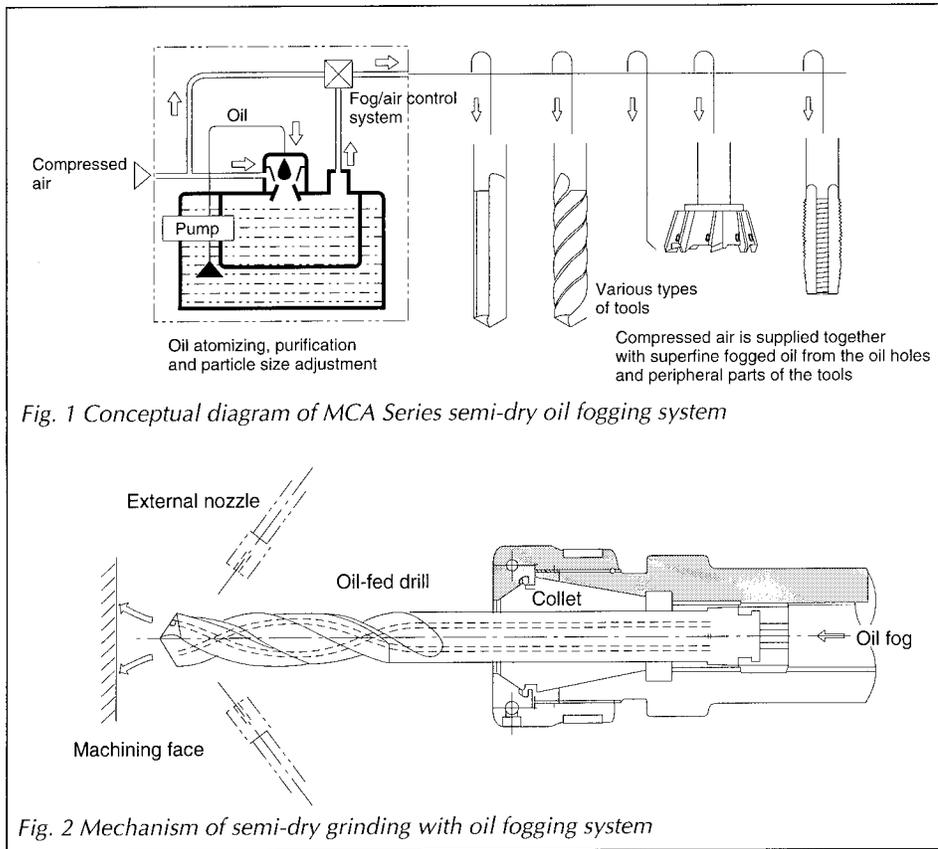


Fig. 1 Conceptual diagram of MCA Series semi-dry oil fogging system

Fig. 2 Mechanism of semi-dry grinding with oil fogging system

compact, they can be mounted on machining centers with ease, and by using a separately sold unit valve in combination, it will be possible to automatically switch over to any of multiple oil mist supply lines in conformance with the machining process.

The standard MCA-01H4 system has an oil mist supply capacity of 0.5-10 cm<sup>3</sup>/hr, equipped with an oil tank of 1,000 cm<sup>3</sup> capacity (800 cm<sup>3</sup> effective capacity), weighs 7.5 kg, and is sold at a domestic price of ¥450,000.

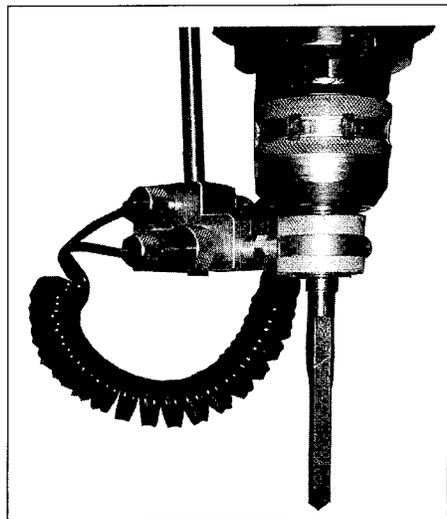
\* **TACO Co., Ltd.**  
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98-04-003-04  
**Oil Hole Attachment Supplies Cutting Oil Mixed with Air from Tool Blade Tip**

Wako Giken Industrial Co., Ltd. has developed an Oil Hole Attachment that supplies cutting oil mixed with air from the tips of tool blades. The attachment can be mounted with ease either horizontally or vertically onto various types of drilling machines, lathes and milling machines for working drills, reamers and end mill cut-

ters which are provided with oil holes. Using the attachment prolongs the service life expectancy, and improves the cutting accuracies and efficiencies of various tools.

Systems supplying cutting oil from the tips of cutting blades have entered wide use recently, but this particular oil hole attach-



Oil hole attachment

ment supplies cutting oil and air simultaneously, so a high chip transfer efficiency and effective cooling effect are displayed,

and the consumption of cutting oil is minimized. The volumes of cutting oil and air can be adjusted in conformance with the machining work to be performed to enable machining under optimum conditions.

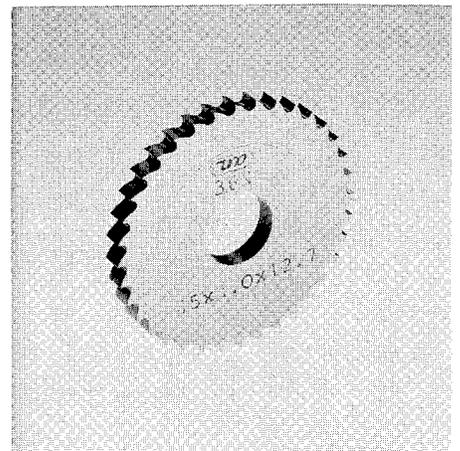
The attachment can be mounted onto general-purpose machines such as drilling machines, lathes and milling machines, also on special-purpose machines, and is usable with drills, reamers and end mill cutters with outside diameters of up to 13 mm. It is sold at a domestic price of ¥72,800-191,600 depending on the specifications.

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98-04-003-05  
**Cemented Carbide Solid Metal Saw**

Uno Co., Ltd. has developed a cemented carbide metal saw C-Wave Saw with teeth of a unique waveform. This construction enables metal debris to be curled during cutting to prevent machine clogging, and enables efficient debris disposal, making grinding safer. A distinct advantage is that burrs and galls are not left on the saw side surfaces. The new saw with unique waveform was developed based on an idea acquired through the brisk sales of a saw of unique waveform in Germany.

Up till now, the saw teeth generally assumed a sharp triangular form, but this construction results in meshing of the ground metal debris when engaging in grinding operations. The new metal saw is equipped with a back-taper boss coupled with a



Cemented carbide solid metal saw

flange. This design suppresses the radial runout of peripheral cutting edge that is liable when simply using a back taper without boss, improves the grinding accuracy and enables precision cutting to a thickness tolerance of within 2  $\mu\text{m}$ .

The saw is made of a cemented carbide alloy containing metals such as cobalt and tungsten, enabling the saw to cut workpieces made of iron, stainless steel, aluminum alloy and titanium accurately, rapidly and without leaving burrs and galls on the saw side surfaces. The saw with a diameter of 70 mm and thickness of 0.3 mm is marketed at a domestic price of ¥4,800.

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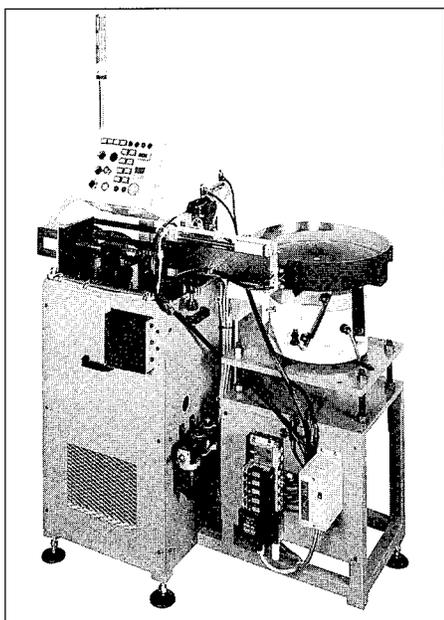
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98-4-003-06

## Compact, High-Performance Pipe Terminal Treatment Machine

Osuga Machine Inc. has developed OM-FI Series and an OMH-FI Series machines for treating the terminals of pipes, in which their sizes are only about one-half compared with conventional counterparts of the same capacity.

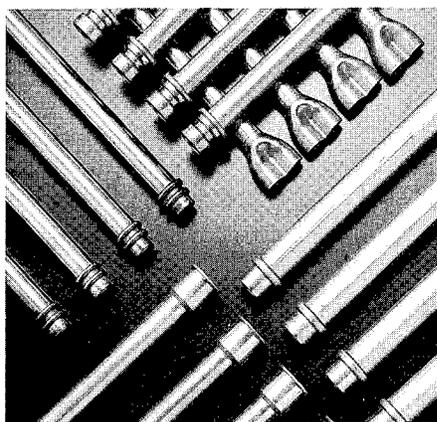
These machines are for the flaring and swaging of pipe ends with a punch die, and are available in either the punch drive or hydraulic drive version. Each of these types



Compact, high-performance pipe terminal treatment machine

	OM-F-1* (Oil-Air Type)	OMH-F-1* (Punch Hydraulic Type)
Pipe working diameter (copper pipes)	$\phi 4\text{--}\phi 12.7 \times 0.8$	$\phi 4\text{--}\phi 19.05 \times 1.0$
Pipe working diameter (steel pipes)	$\phi 4\text{--}\phi 8 \times 0.8$	$\phi 4.76\text{--}\phi 10 \times 1.0$
Number of punches	1~6	1~6
Clamping system	Horizontal clamp (toggle)	Horizontal clamp (toggle)
Clamp cylinder	$\phi 50$ (pneumatic)	$\phi 50$ (hydraulic)
Work cylinder	$\phi 125$ (pneumatic) (Stroke adjustable)	$\phi 80$ (hydraulic) (Stroke adjustable)
Machining speed	1-12 s (per cycle)	1-12 s (per cycle)
Working air pressure	5~7kg/cm <sup>2</sup>	5~7kg/cm <sup>2</sup>
Working power voltage	100V	200V

# Indicates number of punches



Formed tubes

are available in six models with 1-6 punches, respectively. When working with copper pipes, the pneumatic type machines are used for treating pipes with diameters of 4-12.7 mm (wall thickness 0.8 mm), and the hydraulic type machines for treating pipes with diameters of 4-19.05 mm (wall thickness 1 mm). The standard stroke of the punch drive is 50 mm, which can be increased whenever necessary.

These machines are available in a total of 12 models depending on the punch drive system and number of punches, and the machine is marketed at domestic prices of ¥900,000-3,000,000, depending on specifications. The accompanying table indicates the main specifications of these machines

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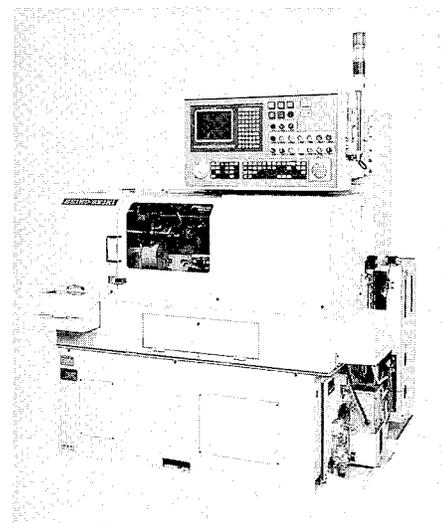
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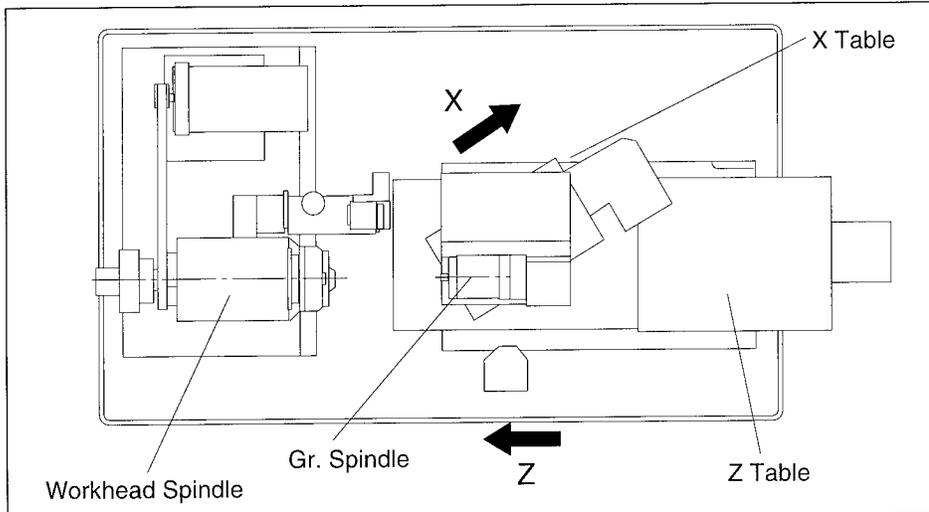
## Internal Grinder of Fivefold Accuracy for Machining Automobile Fuel-Jet Nozzles

Seiko Seiki Co., Ltd. has developed a next-generation version internal grinder 32-Bit CNC Fully Automatic Internal Grinder SIG-SC-UP that features a roundness accuracy level of 0.1  $\mu\text{m}$  for the machining of automobile engine fuel-jet nozzles. This was achieved by applying advanced rotational technologies which led to the development of a unique high-rigidity hybrid bearing assembly consisting of hydrodynamic drive and static drive bearings which is used in the workhead spindle.

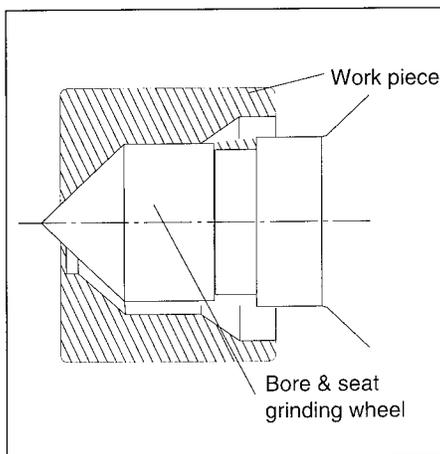
The company's advanced rotational accuracy has permitted the workhead spindle to mount a unique hybrid fluid bearing in which hydrodynamic drive bearings and



CNC automatic internal grinder



Machine layout



Grinding layout

static drive bearings coexist. A unique ceramic ball bearing has also been introduced in the grinding spindle, by which the rotary accuracy has been improved, the vibrations suppressed and the noise attenuated substantially.

Ceramic concrete is used to fabricate the vibration absorbing structure at the grinder leg part, which further decreases the machine thermal displacement and vibrations. Improvements have also been made through the introduction of an angular table to constantly secure a well-balanced rigidity with respect to thermal elongations. Based on these improvements, the nozzle shaping accuracy has been improved five-fold compared with the existing counterparts.

The nozzle shaping accuracy was performed by these improvements, so the performances of gasoline engines are also improved, which in turn suppresses the fuel

consumption rate, decreases the emission of exhaust gas and helps to maintain a clean environment.

**\* Seiko Seiki Co., Ltd.**  
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## Information & Communications

98-04-004-01

### Remote Communication System for Small Offices and Home Offices

Remote Systems Japan Co., Ltd. has developed a moderately priced remote conference system available at a price that is about one-fourth those of existing counterparts for use in small offices and home offices (SOHO). The low price has been realized by eliminating the use of high-performance constituent parts such as the image processing board (printed circuit) built into personal computers.

This kit for use in home offices is marketed under the brand name of SOHO Kit and consists of a home office software, a combination video/audio modem and a CCD camera. The main function of the home office software is to enable various types of information exchange while the parties on both terminals are looking at each other on the personal computer screen and engaging in remote video conferences, also to permit common use of programs, remote control of operations, cyberboard manipulation and file transfer.

The combination video/audio modem enables smooth conversations and data transfer simultaneously, by which the remote conference system introduction into SOHO is eased substantially. The system is usable not only for mutual liaison and transactions with a company or trad-

ing partner from a home office but also for a wide range of operations including the offering of remote teaching sessions such lessons in English conversation and other kinds of lessons, consulting operations, and discussions of medical treatment and creation of designs.

Compared with conventional types of remote TV conference systems, this new system is available at a low domestic price of ¥59,800, so the company anticipates the system to come into wide use especially by enterprises which are already adopting or about to adopt the system of letting their employees work at home.

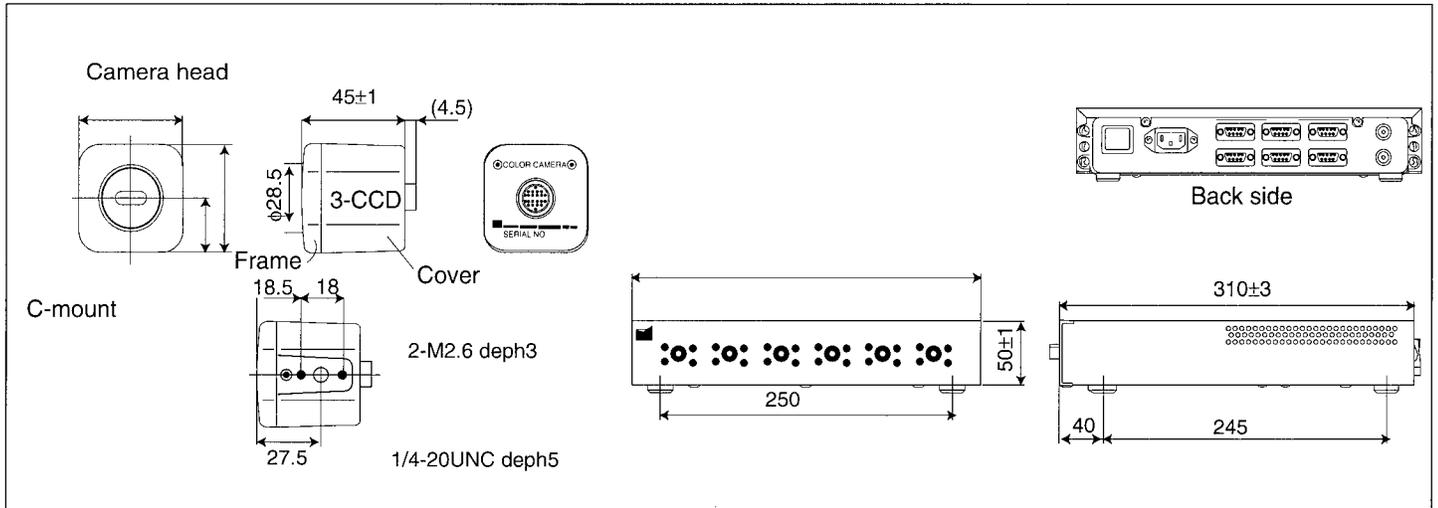
**\* Remote Systems Japan Co., Ltd.**  
 Otaki Bldg, 5-67-5, Nakano, Nakano-ku,  
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98-4-004-02

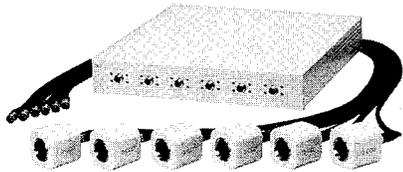
### CCD Color Camera Featuring 6-Head Control with Single CCU

Tokyo Electronic Industry Co., Ltd. will launch 6-head, 3-CCD color cameras CS5860-6H developed specifically for processing color images.

In this new color camera, six ultracompact, lightweight camera heads are controlled with a single camera control unit. An image processing unit is built in to enable the camera to be used for the mass inspection of various types of subjects or to be used as an image input camera for



Description of CCD camera



CCD color camera featuring 6-head control with single CCU

production processes having several production lines. The camera is designed specifically for image processing and features an excellent cost performance. The C-mount standard is adopted for mounting the lens on the camera heads, which makes the camera head ultracompact with a size of  $45 \times 45 \times 45$  mm and as lightweight as approximately 110 g, realizing easy installation into measurement and inspection lines without taking much space.

Up to a maximum of 6 camera heads can be controlled with a single space-saving camera control unit, and the camera heads can be connected to any of the controller connectors. The camera has a total of 410,000 pixels, uses 1/3-inch CCDs, and high-fidelity color reproduction is possible thanks to high horizontal resolution of 570TV lines for all the primary colors of red, green, and blue (RGB) respectively. No pixels are shifted, so the camera is ideal for use in image processing. The video output is for RGB only. Images captured by each of six camera heads are output through dedicated D-SUB connectors.

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98-04-004-03

## Image Data Compression Using Neural Network

The Communications Research Laboratory of the Ministry of Posts and Telecommunications and M. Ken Co., Ltd. have applied neural network technology to jointly develop stationary image data compression software featuring an excellent compression ratio which retains an excellent image quality.

Compression is performed by deducing a magnification ratio of minimal image deterioration through learning and based on the color and brightness of the target image. When compared with JPEG, the international standard for static image compression technology, the time necessary for returning to the original image is about 100 times faster, and there is little dispersion in the restored (decompressed) image.

The newly developed software is patterned after the human neural system, and the neural network technology is applied for automatically learning the necessary compression operations efficiently through repetitive data input. The software uses as learning data the brightnesses of the three primary colors of red, green and blue which comprise the image. The image is divided into fine blocks, and the average brightness and the disparity of the respective colors are computed. For multiple blocks close to the mean value, the learning operation is repeated for about 1,000 times to change the compression ratio and to compare the difference between the original and the decompressed image, through which the

maximum compression ratio is discovered for which the deterioration of the image is minimal.

Software using the JPEG standard features a compression ratio that is constant and about one-thirtieth of the maximum, so a compression ratio matched to the image quality cannot be selected. With a target image such as a human face, in which human vision can discriminate differences sensitively, the image quality is deteriorated substantially.

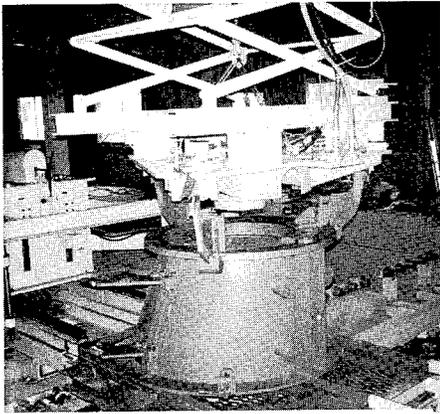
With the new software, the time for learning at time of compression is over five times longer than that of the JPEG standard, but when using a workstation at time of decompression, the operation is completed in about 3 sec with a standard type of digital photograph. At present, there are problems which have to be resolved, such as the problem of the block surface boundary remaining on the decompressed image, so these problems will be resolved to commercialize this image compression system.

The compressed image incorporates much information relating to the characteristics of the original colors, so the research team observes that the new image compression technology would be highly convenient for the establishment of a static image data base that can be searched, for example, with a keyword such as a reddish suit.

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HC System Manufacturing Process

The HC System Manufacturing Process capitalizes on the advantages of these two types of forming methods and considerably shortens the time for curing in the process of manufacturing concrete products in general. The number of molds is decreased and the production volume per unit time also increased considerably, so fixed costs are decreased substantially. In addition, the increased initial-stage concrete strength improves the mold turnover, shortens the product manufacturing time and enables labor conservation.

The company also succeeded in establishing a Completely Automated Manufacturing Line for completely automating the processes of mold freeing, mold assembling, molding and curing by adapting the HC System Manufacturing Process to the fabrication of inclined manhole walls, which decreases the total project cost through reduction of manufacturing cost and labor conservation.

\* **Haneda Humepipe Co., Ltd.**

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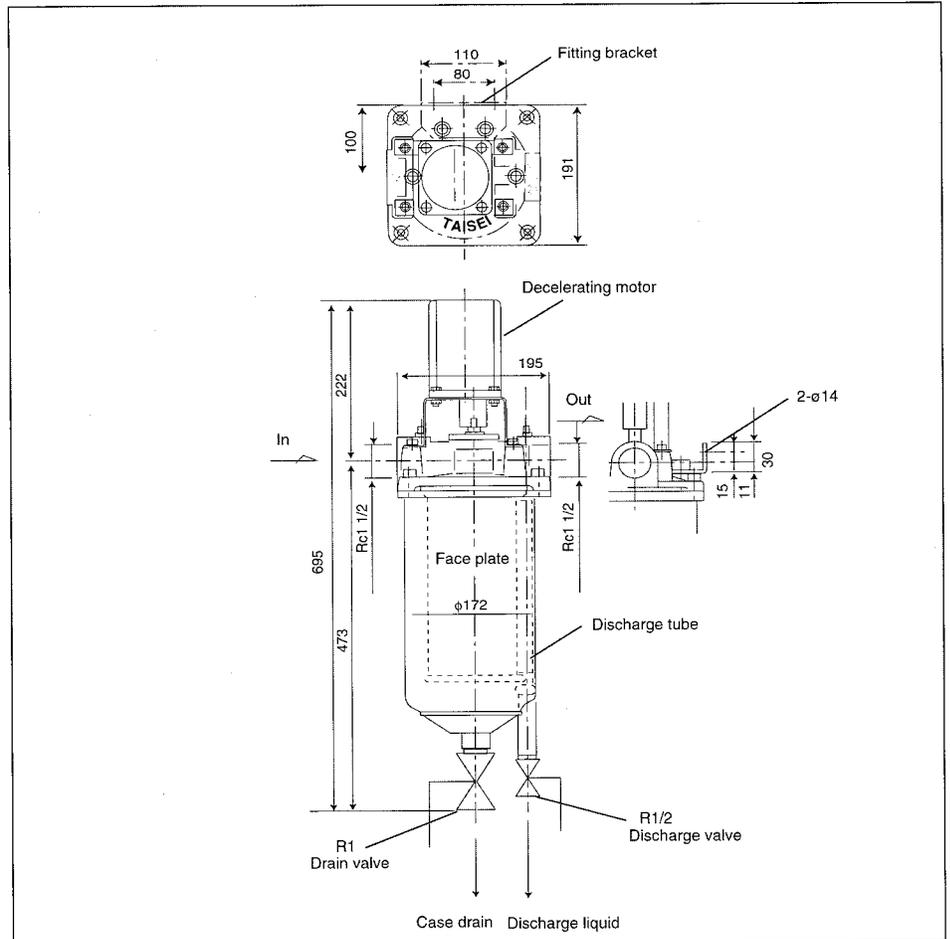
Tel: +81-3-3345-7831

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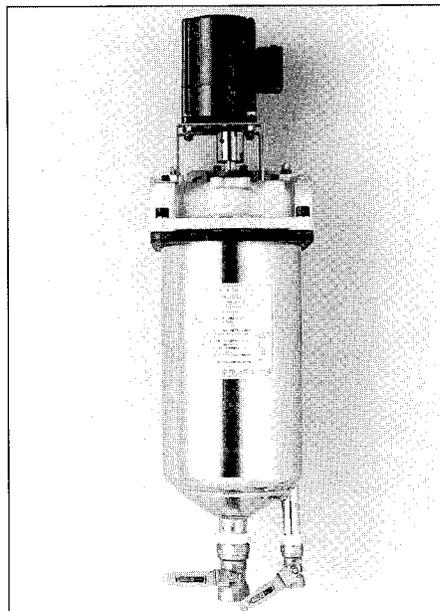
## 98-04-005-03 Filter for Selectively Removing Nonmagnetic Grinding Chips

Taisei Kogyo Co., Ltd. has come out with an experimentally fabricated "DM Type Motor-Driven Autoclean Filter" that selectively removes nonmagnetic grinding chips such as aluminum chips which float inside coolant settling tanks and are difficult to collect for removal. The filtration system's selling price is undecided as yet, but expected to lie about ¥100,000.

28



Dimensional outline drawing



DM Type Motor-Driven Autoclean Filter

This filtration system sucks up coolant fluid existing in a settling tank and containing grinding chips, and passes the fluid

through cylindrical filtration elements for filtration. The grinding chips adhering on the filtration elements are loosened into numerous discharge tubes provided densely by revolving these filtration elements with a reduction gear motor, then discharged outside the system continuously from the discharge tubes.

This system enables substantial labor conservation since the cumbersome disassembling and cleaning tasks associated with conventional types of filtration systems are eliminated. Also, the grinding chips settling to the bottom are removed by opening a drain valve. The filtration element was developed by the company and is available in five models ranging in filtration accuracies of from 50 micrometers to 200 micrometers. The rated flow rate is 50 liters/min, and the three-phase motor has a rated voltage of 200 V.

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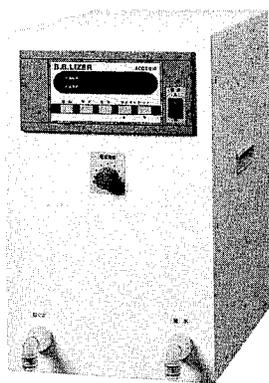
Fax: +81-3-3936-0030

98-04-005-04

## Composite Electrolysis System for Generation of Acidic and Alkaline Water

Access Clip Co., Ltd. has developed the first composite electrolysis system that can produce highly acidic water with excellent sterilization effect and weak alkaline water for suppressing oxidation and putrefaction by one system. This new system will enable the food processing industry to improve existing sanitation control and quality assurance as well as to decrease the generation of wastes. The system is operable at a cost of less than ¥1/liter, and the company plans to set the system selling price at about ¥1,120,000, about the same price as those of existing systems used by medical treatment enterprises but which display only a single function of generating strongly acidic water.

The system is called B. B. LIZER, is (W)240 × (D)350 × (H)380 mm, and weighs 14 kg. The compact system features a substantial energy conservation effect due to the use of high-performance electrolysis tank wafers and distributing panels. Faucet water and electrolysis promotion salt are used as the raw materials, and 1.5 l of both highly acidic water are generated per minute with a power consumption of 66W and weak alkaline water are generated per minute with a power consumption of 400 W, together with the same volume of waste water. By switching the system mode of operation, strongly acidic water and weak alkaline water are obtained from separate outlets.



B. B. LIZER

The strongly acidic water kills bacteria and microorganisms instantaneously, then transforms into ordinary water subsequent to the sterilization effect, and there is no residue as with chemicals. In addition, it is entirely harmless to the human body, and since it has a pH value of less than 2.7, use in toilets enables the pathological E. coli O-157 and other miscellaneous bacteria to be sterilized completely. Meanwhile, using the weak alkali ion water of pH 10 value for washing and cooking vegetables retards food putrefaction and improves the flavor, which also suppresses the generation of wastes.

The company anticipates that the strong acidic water will gain acceptance by hospitals for use in place of alcohol to prevent infections, while the weak alkaline water is expected to be used in restaurants for health and sanitation promotion.

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98-04-005-05

## Gas Separation with Carbon Molecular Sieve

The National Institute of Materials and Chemical Research, a laboratory of the Agency of Industrial Science and Technology (AIST), has developed an effective molecular sieve made of carbon to separate a binary mixture of molecular gases into its components. The carbon molecular sieve (CMS) is a membrane of a porous matrix of amorphous carbon with dis-

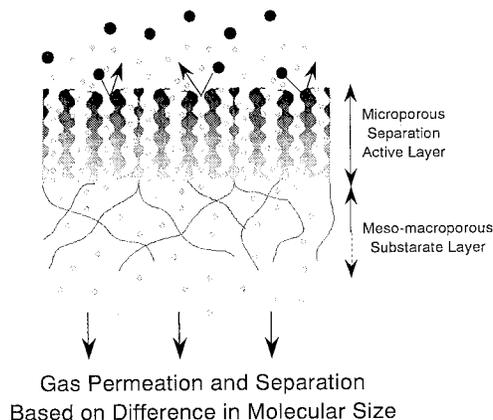
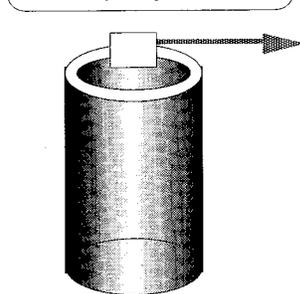
persed microscopic graphite-like crystals. The micropores are tailored to a mean size that allows the component gas with smaller molecules to diffuse through the wall, but not the larger molecules.

As an application of molecular sieve technology, the CMS approach naturally requires with much less operation energy than traditional processes involving phase changes. Previous molecular sieve devices have used a separator membrane of silica or polymers. The CMS device can be produced at a lower cost than silica molecular sieves, and is invulnerable to heat, chemical attack, and mechanical shock, an advantage over polymer sieves.

The CMS membrane is prepared by pyrolysis of a polyimide film, and is largely made of amorphous carbon matrix in which tiny graphite-like carbon crystals are suspended with the amount of crystals depending on pyrolytic conditions. High-temperature stoving makes the size of micropores small and selectivity high.

The Institute conducted tests to estimate the gas selectivity of the CMS membrane in room temperature, and demonstrated, for example, that a specimen CMS membrane passes 4,700 times more H<sub>2</sub> gas than N<sub>2</sub> gas (H<sub>2</sub>/N<sub>2</sub> selectivity:4,700). The He-, Ne-, CO<sub>2</sub>-, and O<sub>2</sub>- selectivities of the specimen to N<sub>2</sub> are 2,800, 208, 122, and 36, respectively. The tests proved the CMS is several times more selective than polymer-membrane molecular sieves. With a little modification, the membrane can separate an alkene (e.g., propene) from a homologous alkane (e.g., propane).

CMS Capillary Membrane



Aiming at practical gas separation, the Institute made a CMS capillary. The process began by coagulating a polyamic acid (PAA) solution around a polymer tube. The core tube is removed, and the hollow line is imidized to produce a polyimide capillary, which is then pyrolyzed to produce a CMS device. The prototype capillary had an outer diameter of about 1.5 mm with a wall 100-150- $\mu\text{m}$  thick. The wall had a dense skin and an inner body with dispersed micropores, and features changing with the coagulant used to prepare the polyimide workpiece.

When the coagulant was ethanol, the skin was some 10  $\mu\text{m}$  thick, and the inner

body had no larger pores. The CMS selectivity was superb. In contrast, water coagulant caused the carbon capillary to have a much thinner skin and a wall body with larger pores. The permeability of component gases was tens of times greater than the ethanol-coagulated type, but the selectivity was rather poor, presumably because some wall pores had grown to disrupt the skin.

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uid segregation inhibitor is advantageous in that the addition is reduced to one-tenth (in terms of solid content) and that the dissolution/charging process is much easier and simpler.

PNVA, formed by polymerization of high-purity N-vinylacetamide (NVA), provides a highly polymerized linear polymer with acetamide groups in its side chains. This polymer can be dissolved in water or alcohol, resists hydrolysis, and features excellent thermal stability and ultraviolet ray stability. By introducing an appropriate net structure into this polymer, a water absorption resin is obtained that features a water absorption performance about 30 times greater than that of existing counterparts.

Based on the affinity created through the hydrogen bonds between water molecules and amide groups inside PNVA, the elasticity possessed by the polymer chains and the osmotic pressure generated by the mixing entropy between water and resin, the water molecules are absorbed gradually into PNVA (see Fig.). However, since PVA possesses no ionic groups, no specially strong bonding is generated with the ions in water.

### Possible Fields of PNVA Applications

- (1) Civil Engineering and Construction
  - a. Expandable water-resisting rubber
  - b. Seawater absorbing soil
  - c. Water shielding sheet
- (2) Household Products Basic Material
  - a. Water absorber for moisture inhibitors
  - b. Aromatic base materials
  - c. Repellent base materials
- (3) Vegetation Water-Retaining Agents
  - a. Greening of deserts
  - b. Greening of side slope
  - c. Cultivation of foliage plants
  - d. Cultivation of seedlings of various vegetation
  - e. Callus cultivation medium
  - f. Base materials for slow-release fertilizers and agricultural chemicals
- (4) Diverse waste-liquid absorbents
- (5) Internal covering for cables
- (6) Others

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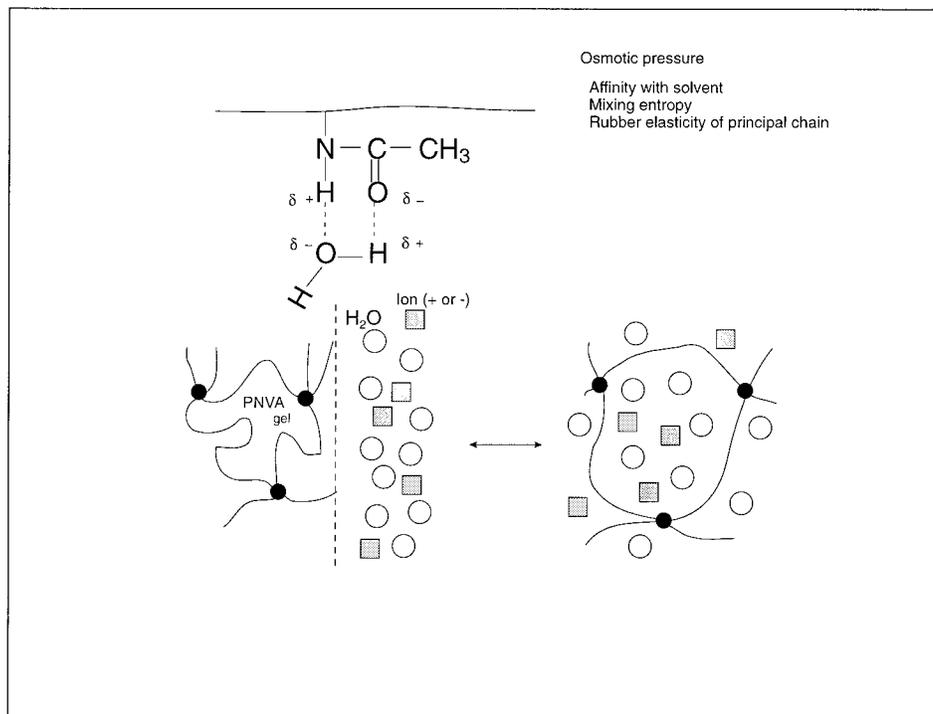
## Construction & Transportation

98-04-006-01

### New Liquid Segregation Inhibitor for High-Fluidity Concrete

Showa Denko K.K. (SDK) and Chichibu Onoda Cement Corp. (COCC) have jointly developed an innovative liquid segregation inhibitor for high-fluidity concrete.

The new agent consists mainly of poly N-vinylacetamide (PNVA). SDK has become the world's first company to develop an industrial-scale process to synthesize N-vinylacetamide monomer (NVA monomer) from which this innovative polymer is produced. Compared with conventional types of powdered products, the new liq-



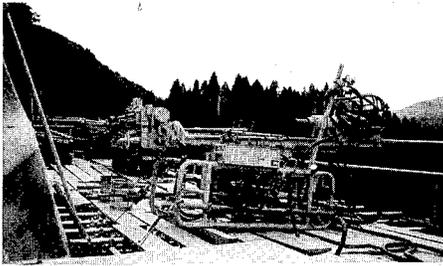
Water absorption device of PNVA water absorber

98-04-006-02

### Impact Drill of High-Speed Hole Drilling

Front Engineering Co., Ltd. has marketed an M-Series Miniature Impact Drill that enables hole drilling operations to be performed rapidly and most efficiently. It is compact, lightweight, mounts a fully hydraulic rotary percussion, and is sold at a domestic price of ¥15,500,000.

The drill displays an excellent efficiency in hole drilling operations for small-scale anchor bolt installation works and for lock bolt installation on slope planes for foundation stabilization which have increased recently. Its weight has been suppressed to 550 kg to permit use on small scaffolds (up to about 3 m) on steep inclined planes where large drills cannot be used, while the drill disassembled weight is also less than 100 kg that permits the drill



Lightweight, hydraulic rotary percussion drilling

to be conveyed into and assembled at the worksite.

The introduction of a backhammer mechanism permits rapid hole drilling regardless of the type of terrain, the drill lightweight enables the scaffold cost to be reduced, also project cost reduction due to less expenses for moving the drill and workers. The mounting of a fully hydraulic rotary percussion provides excellent drilling capability, the digging of casings is also possible, and the drill has a wide range of applications by combination with the single pipe excavation method. In addition, the introduction of the backhammer mechanism permits avoidance of jamming, so hole drilling on colluvial slopes is accomplished with ease. Further, the booming mechanism can be shifted by 350 mm horizontally while retaining its angle. A electric-driven or an engine-driven power unit is selectable.

As optional specifications, a base unit is also to be marketed that mounts running tire can be converted into a skid whenever necessary, as well as caster unit which is grounded only transfer.

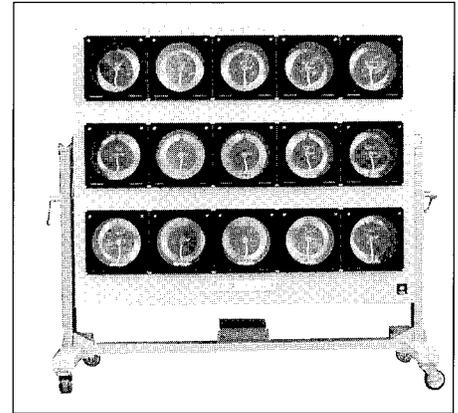
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Solar simulator

This simulator is applicable for all kind of experiments requiring the use of natural sunlight, such as testing and evaluation of solar cell performances, research relating to biotechnology utilizing natural light, and tests of sunlight resistances of various types of construction materials.

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98-04-007-02

### Inexpensive System Integrating Photovoltaic Power Generation Module and Roof

Hirai Engineering Corp. has commercialized an extremely inexpensive system that integrates a photovoltaic power generation module and its ancillary roof through the world's first TH type standard specifications, and is based on standardization of the photovoltaic cell module.

Four types of modules are used in combination for compatibility with all kinds of roofs, so due to mass production and reduced fabrication cost, the investment cost has been decreased to less than one-half that of the least expensive conventional system. A system with an output of 4 kW can be assembled at a cost of about ¥1,800,000 that can be depreciated in about 7 years. This photovoltaic power generation module of versatile specifications was devised based on experience gained through roofing business. It is comprised of cells of four sizes, which are five or six 10-cm<sup>2</sup> cells arranged vertically, and eight or nine cells arranged laterally.

The configuration of the aluminum support frame is changed flexibly in conform-

## Energy & Resources

98-04-007-01

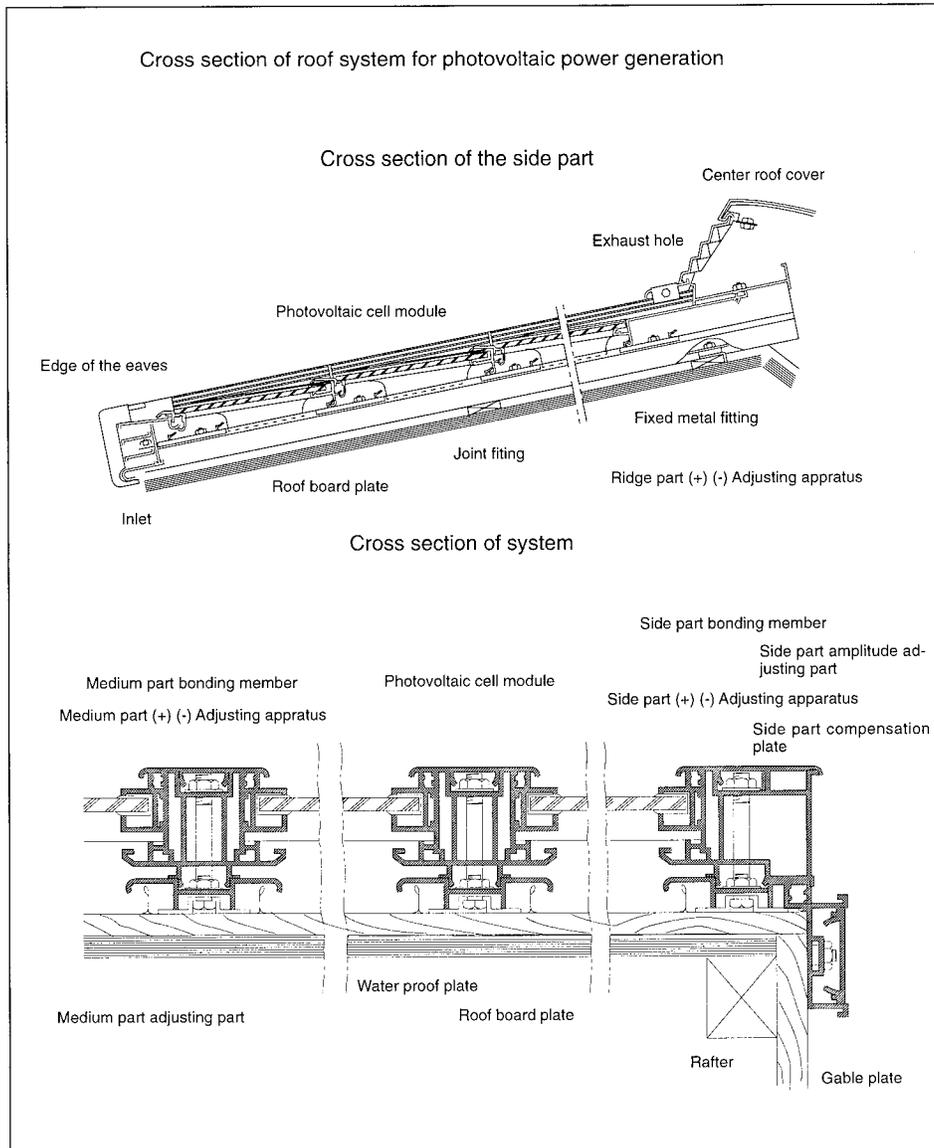
### Illumination Type Solar Light Simulator

Seric Co., Ltd. has developed a solar simulator. This system is a dummy solar light generator adopted xenon lamps. The light from a xenon lamp is passed through a unique spectral compensation filter developed by the company, by which light radiation very close to that of natural sunlight has been realized.

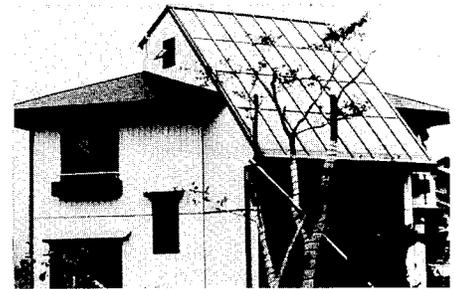
When comparing with a natural sun light, the simulator has been recognized as a Class A type in conformance with the standards prescribed by the Japanese In-

dustrial Standards (JIS). And also, its radiation intensity has realized the same as direct projection natural solar light in the mid summer.

The irradiation area is 1,200 mm wide and 800 mm tall, the radiation intensity 1 kW/m<sup>2</sup> and the irradiation distance 3 m. The simulator is designed to meet a wide range of user needs in connection with the dimensions of the effective irradiation area, the irradiation distance, the necessary light wavelength range and light parallelism, and a simulator with other specifications can also be supplied.



TH type system integrating photovoltaic power generation module and roof



Inexpensive system integrating photovoltaic power generation module and roof

have been acquired domestically, as well as in Europe and the United States. An AC module incorporating an inverter to convert DC power into AC power has already been completed, and the preparation of a franchise chain is already under way.

Sales representatives will be licensed to engage in the manufacture and procurement of necessary materials such as the cells and support frames, and to accept orders from homes and enterprises desiring to install the photovoltaic power generation system.

The system cost per one square meter can be reduced to ¥12,000 excluding the solar cell, so the key to lowering the system cost will depend on the solar cell. The cell cost on the domestic market is ¥250 per KW in contrast with the overseas cost of about ¥130. If a general household consumes 4 KW of power, use of the import cell will lower the system cost by about ¥500,000. The cost of the inverter is higher now, but it is expected that the cost can be lowered to about one-fifth.

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## 98-04-007-03 Combustible Gas Generated by Water Electrolysis

Koyo Co., Ltd. has started marketing a system to manufacture a combustible gas "Green Gas" that is generated by water electrolysis. No toxic substance is generated by the combustion of Green Gas and the combustion is performed at a high temperature of about 3,000 °C, so the generated combustible gas is usable for treating steel materials as well as to cope with

ance with the roof size, so there is no need to fabricate the roof to the necessary size through independent production. Rain drainage of the roof system uses the labyrinth to prevent infiltration of rain water by capillary action and surface tension, and comprises a waterproof structure equipped with triple and quadruple lines of rain water drainage grooves.

The roof system for photovoltaic power generation is lined along the inner lower part of the module with fireproof iron plates, and the system has already been approved as a fireproof structure by the Ministry of International Trade and Industry and the Ministry of Construction. The structural members all consist of light-

weight aluminum, the assembled portions are provided with spaces and fixed in position securely with bolts to render the structure proof even against large earthquakes. In addition, the structure is highly resistant even against strong winds of 70 m/sec. The system can be mounted into position by the knockdown assembling method indicated in the catalog, and there is absolutely no need for work on the roof, so can be assembled with ease by the home carpentry method.

With the cooperation of construction material manufacturers, technology and performance demonstrations have already been completed, and more than 130 patents and other industrial property rights

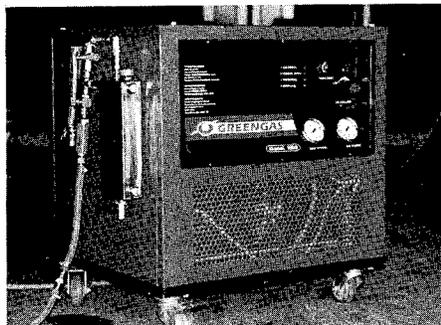
## NEW TECHNOLOGY & PRODUCTS

the dioxin issue. The gas generator is sold at a domestic price of ¥2,500,000 and the water treatment system at a price of ¥198,000.

The Green Gas Generator "NEO" produces a flammable mixed gas consisting of 2 parts of hydrogen and 1 part of oxygen by using water as the fuel. This means that the gas is recycled into water (vapor) after being burnt, so there is no problem of effusing pollutants when using a fossil oil as the fuel. Furthermore, the gas emits no CO<sub>2</sub> that is believed to be one of the causes of the greenhouse effect, SO<sub>x</sub> that causes acid rain, or NO<sub>x</sub>.

"NEO" consists of two inner mechanisms, the electrolysis mechanism and the water activation mechanism. The electrolysis mechanism converts normal tap water into a mixture of hydrogen and oxygen without using an ion exchange membrane or impermeable membrane, both of which are indispensable for traditional technologies. The water activation mechanism (CWS unit) further increases the effectiveness of the electric conductivity of water by activating the water and consequently enhancing the water electrolysis efficiency.

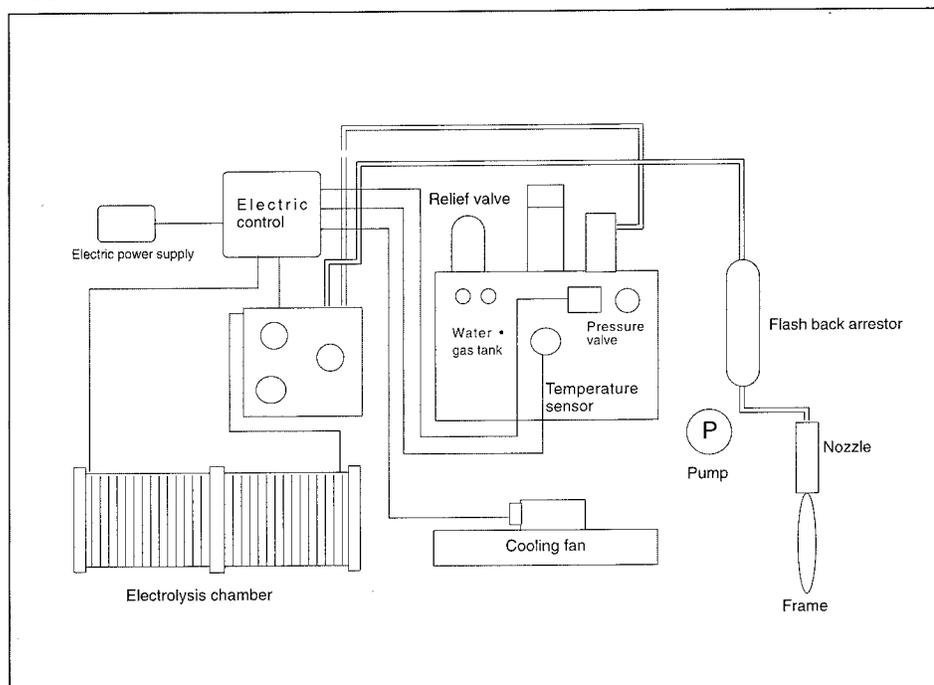
The Green Gas Generator features a simple construction and consists of an electrolysis chamber, a water tank, a circulating pump, a set of cooling fins, an electric



Green Gas Generator

control panel and the CWS unit. The mechanism of the CWS unit is divided into four stages. A galvanic battery reduces the size of water clusters by an electric field, a permanent magnet makes the water clusters even smaller, tourmaline ore causes the water to contact the magnetic electrode to decompose the water into positive and negative water ions, and a specially designed ceramic increases the degree of alkalinity.

The newly marketed system features an excellent flammable gas forming efficiency since the raw material water has pretreatment, so is operable at a low running cost. The water pretreatment unit is a mechanism the company developed for treating drinking water. Tap water contains added water-soluble calcium, and alkaline water with electrically charged particles is produced by action of the tourmaline ore



Green gas generator

electrical effect and the magnetic effect, without using outside electric power. The gas generator forms 1,500 liters/hr of "Green Gas" with 0.8 liter of water.

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98-04-007-04

### Alkali Battery Discharge Performance Improved by 20%

Fuji Denki Kagaku (FDK) Co., Ltd. will market a newly developed UM-3 alkali battery featuring a service life that is the longest in the trade from March this year. Meanwhile, it plans to market its first character product Pokemon Dry Cell on a full scale, which it had been marketing partially previously.

The new UM-3 battery features a discharge performance that is improved by a maximum of 20% compared with its existing counterparts. The battery displays a well balanced performance and improving the functions of a wide range of equipment from audio/video equipment which use alkali dry batteries predominantly to portable telephone units working on large currents. The anode reaction area has been increased and a new filling technology introduced that increases the volume of electrolyte packing, while a new gel type cathode of small contact resistance with collector ring have been developed newly, which decrease the cell internal resistance. A new raw material separating displaying excellent retention of an electrolyte is installed. A long service life has been attained that is equivalent to about one hour of continuous playback of mini-disk (MD) player.

The company also plans to market before summer this year a UM-4 battery featuring a long service life and which is an application of the same technologies. Also, the character battery adopts Pokemon Pikachu and Raichu designs. These UM-3 and UM-4 batteries are sold in a package of four batteries and contain a Pokemon character seal. The selling price is ¥160 per battery, the same as before.

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## Environment

98-04-008-01

### Domestic Waste Water Purified with Useful Plants

Y. Ozaki of the Water Quality Control Laboratory, Department of Soils & Fertilizers, National Agriculture Research Center, Ministry of Agriculture, Forestry and Fisheries has corroborated that a waste water purification system using useful plants such as tomato and chrysanthemum plants reduces the nitrogen concentration to 0.3 ppm and phosphorus concentration to 0.06 ppm from domestic waste water. Therefore, the system serves the double purpose of purifying the water quality and culturing of useful vegetables. The future plan is to utilize the system for purification of domestic waste water in agricultural village, home vegetable culturing and greening of urban regions. This system consists of the joint treatment plant and biogeofilter ditch.

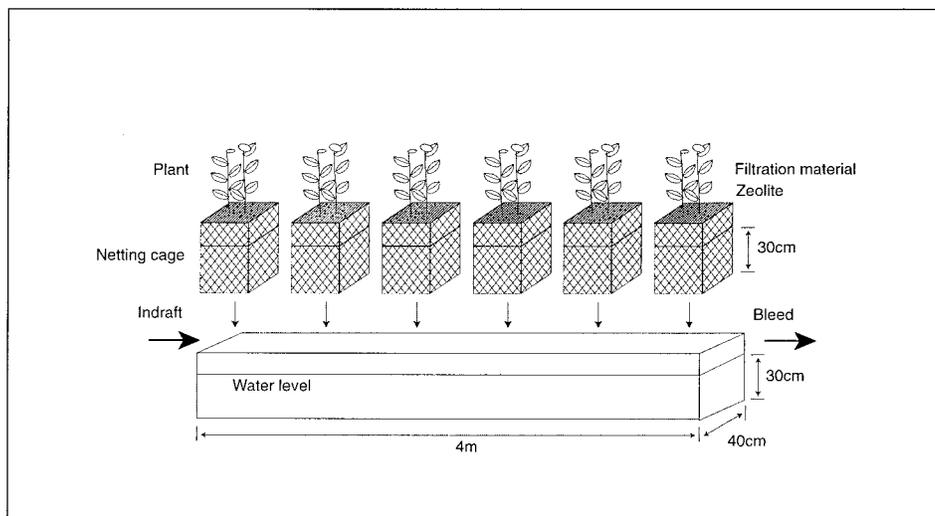
Water purification systems using aquatic plants such as water hyacinth and reeds have been available previously, but since the utilization of these plants as biomass is rather difficult, these systems have failed to enter wide use. The research team developed a biogeofilter ditch that enables simultaneous utilization of aqueous plants



Vegetation status of biogeofilter ditch plant

and land plants, a demonstration plant was installed in Ozaki private garden, and tests were continued for a period of about four years.

With the biogeofilter ditch, as indicated by the accompanying diagram, the height of packing zeolite in the waterway is changed in conformance with the moisture resistance of the plants, to permit the utilization of land plants of high utility values such as vegetables, useful plants and flowers for water purification. The waterway is 19.5 m long, 40 cm wide and mounted on a netted cage packed with filtration materials such as zeolite and Kanumatsuchi, and the water level adjusted in conformance with the moisture resistance of these plants.



Type chart of biogeofilter ditch

In order to generate good quality effluent water with stability, a biogeofilter ditch of about 3 m<sup>2</sup>/person will be necessary, and supposing that this waterway is fabricated with existing U-shaped concrete grooves, the main material costs for a waterway for a household of 5 individuals will consist of about ¥220,000 of U-shaped grooves and about ¥100,000 of zeolite, but by utilizing locally available materials effectively, the system cost can be reduced further.

In the experiment, vegetables such as tomato, chrysanthemum, Irish potato, arrowroot and papyrus were cultivated.

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### 98-04-008-02 System to Recover Volatile Oils from Sludge and Waste Oils

Creative Science Laboratory Co., Ltd. has developed a Volatile Oil Recovery System for use by small-scale enterprises such as paint shops and dry cleaning shops that enables recovery of trichloroethylene (trichlene) and other organic chlorinated substances at a low cost and therefore reduce the after treatment cost as well as the cost of procuring solvents.

The system jets water vapor into the sludge to cool and to separate the water and oily contents, so the oil content of greater density is settled to the bottom of the treatment facility for removal and recycling. The system utilizes the low boiling temperature of harmful solvents including tetrachloroethylene (perchlene) contained in the sludge, and heats the water to about 100 °C with vapor to selectively separate these toxic substances from the waste solvent.

Experiments with 1 kg of the sludge generated by a dry cleaning shop and containing about 313 g of tetrachloroethylene confirmed that the system can efficiently recover the substance by about 297 g, or by over 80%, in 20 min.

The vapor temperature is controlled to maintain a good balance between the vapor and the water, so the solvent mixed into the residual vapor inside the distillation chamber is not returned into the sludge. The recovered solvent can be reutilized by the enterprise, and while a por-

tion of the solvent remains in the treated water, it can be utilized in circulation for generating vapor. The sludge is normally consigned for treatment as waste oil, and the treatment cost is also comparatively low. The research team plans to market a compact system and to suppress the system domestic selling price to about ¥1,300,000. The system will be fabricated by Osaka Electric Industrial Co., Ltd. and marketed by Creative Science Laboratory Co., Ltd..

**\* Creative Science Laboratory Co., Ltd.**  
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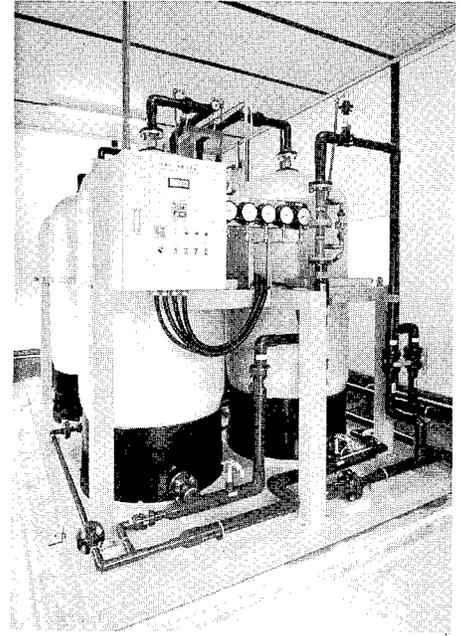
## 98-04-008-03 Removal of Arsenic and Fluoride from Water by Activated Alumina

Swato Inc. has developed a system for removing arsenic which is a toxic substance and a carcinogen, as well as fluoride, available at a comparatively low initial capital cost, and there is no hazard of

secondary pollution caused by the generated waste.

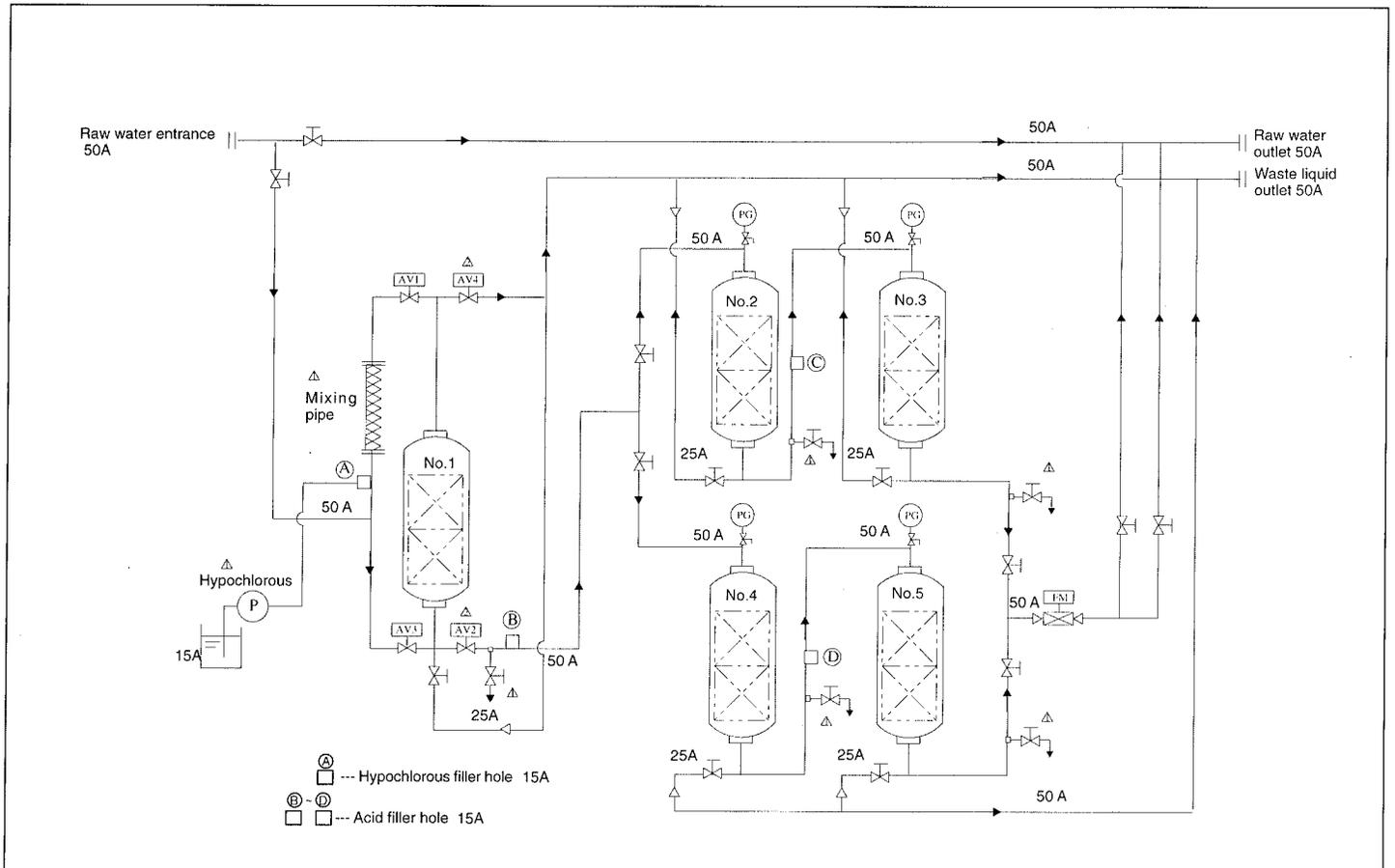
This system is based on the activated alumina adsorption process that displays a special catalytic effect can be handled in similar manner as granular activated carbon, and specifically adsorbs arsenic and fluoride from the water. Since the treatment systems generally using no chemicals, the raw water can maintain the original quality with little change, that is attracting attention as a system which is most suitable for both life and the environment.

Activated alumina is a substance made by roasting and dewatering aluminum hydroxide of high purity. It is a crystalline metal oxide adsorbent obtained in the form of granules with surface area of 270-340 m<sup>2</sup>/g. It is not influenced adversely by the presence of chlorine, chloramine, calcium, magnesium, sodium, high-turbidity and nitrogen in the water. It is also prepared by selecting and blending the granules displaying the optimum shape and mesh size from among several different type of me-



System for removing arsenic which is a toxic substance

dia. The arsenic density of 0.25 mg/l is reduced to less than 0.001 mg/l. The water is passed through a tank filled with 2000kg of activated alumina adsorption-filtration



media for the purpose of only arsenic removal. With this system, the media can be used for one year at least and replacement is not so difficult. If the water pH is adjusted to 5.5-6 level, the media can maintain the treatment capability for a larger quantity of the water. The system initial capital cost is approx ¥20 million, and the maintenance costs about ¥2 million including the media exchange.

The reverse osmosis sedimentation membranae process and the coagulation process with chemicals such as iron salts and aluminum salts are used to settle floating waste containing arsenic, but the initial capital costs of these systems are rather high, and secondary treatment of the generated sludge is necessary. The newly developed activated alumina treatment system is more gentle to the environment, in addition to easier maintenance with a relatively low cost. Compared with some existing systems, it is available at a cost from one-half to one-third, can be installed in a space that is much smaller than that required by the coagulation system in particular, and the energy cost is also low because the system consumes a minimal amount of electricity.

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98-04-008-04

## Panel Made of Diatomaceous Earth

Taiga Construction Co., Ltd., by technical transfer from LFL Science & Technology Laboratories, has succeeded in producing a panel made of diatomaceous earth that features excellent humidity conditioning effects, and has started producing samples of the panel for use as a ceiling finishing material. This panel prevents dewing, or inhibits the generation of molds which are the causes of allergic symptoms such as atopy, so the company anticipates the new panel will be in demand as a construction member for producing airtight and insulation housing units.

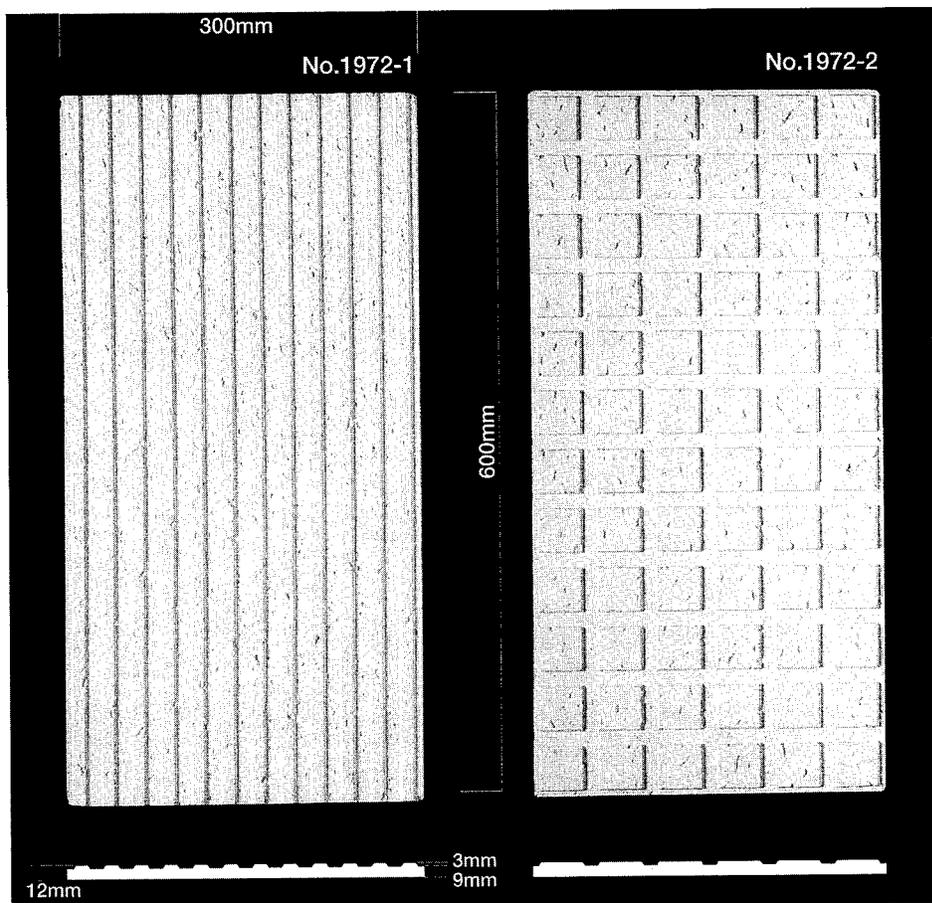
The panel comes in the size of 600×300×12 mm, and will be marketed by the company affiliate Sun Plus Co., Ltd. from January 1998, at a price that is about the same as those of conventional types of classy finishing boards. Attention had

been directed on the diatomaceous earth, but with ordinary methods, it was difficult to produce inorganic panels. The wet process is also being applied, but this process has not come into wide use since much time is required for the panel drying to a certain degree, also since an organic synthetic adhesive agent has to be used as the bonding paste. These problems were resolved by the new process that permits inorganic boards to be produced in an environment consisting of 2.0% carbon monoxide.

The panel primary ingredient is aggregate consisting of nearly 70% of diatomaceous earth, and hard silica is mixed as a bonding agent. The diatomaceous earth is a fossilized product of algae which are essentially vegetable planktons, and has long been used as an excellent fire-resisting material for producing fireproof heat insulating bricks and clay cooking stoves. The main ingredient is silicic acid that is the same as the component of glass, and prevents the generation of dewing by automatically retaining the humidity inside

rooms within a certain range due to its multiporous structure that displays an excellent absorbance and emission that is several thousands of times greater compared with that of charcoal. The material porosity also proliferates bacteria on the walls and ceilings, which decompose pollutants and retain interior air clean and sanitary, and prevent of discoloration the walls and ceilings by tobacco nicotine.

Diatomaceous earth is lightweight and has a density of 0.4g/cm<sup>3</sup>, and the panel weighs only 10 kg per square meter, and when retaining water, is about the same as that of a gypsum board. In addition, the panel can be produced at room temperature by the vacuum atmospheric pressure process, so no carbon dioxide gas is generated during manufacturing. It contains no adhesive like plywood, so does not vaporize formaldehyde that is the cause of sick house symptoms. Further, the panel features an excellent humidity regulating function, so when used in the ceiling, for example, an excellent air-conditioning effect is displayed.



Panel made of diatomaceous earth

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98-04-008-05  
**Inorganic Coagulant Composed of Fossil Shell and Gypsum**

C. & U. Co., Ltd. Chiikishinkou Jigyo-Dan Co., Ltd. has established a new system to clean industrial plant waste water and contaminated river water. The use of a new treatment agent consisting of natural ingredients intensifies the system treatment capability, and simplifies related facilities.

The newly developed treatment agent, called Econite, is a powdery agent consisting primarily of a fossilized shell available in Hokkaido. The fossil is ultraporous and has numerous surface

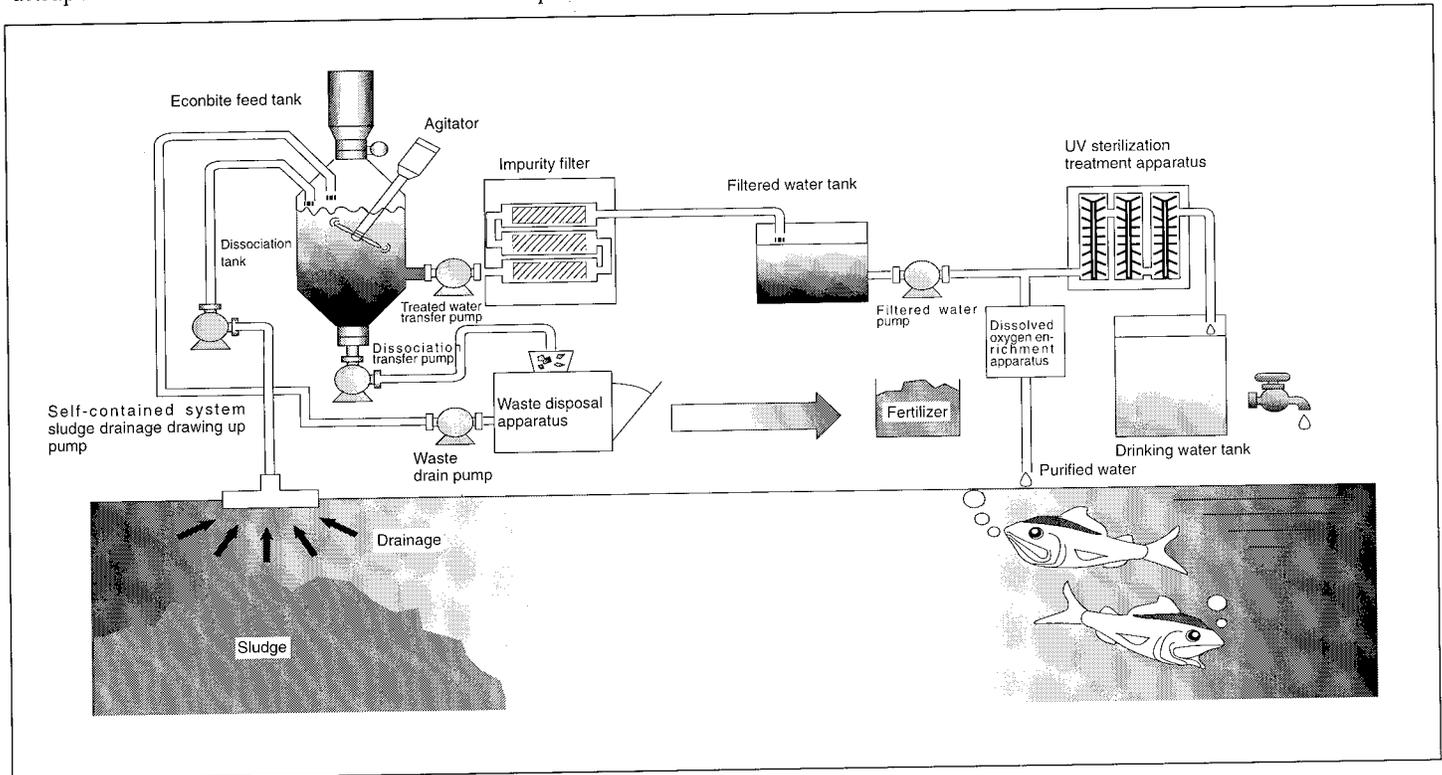
polyaluminum chloride (PAC) and liquid aluminum sulphate (LAS) for settling the suspended substances in pond water and industrial waste water. Since it provides a greater settling rate relative to PAC and LAS, a larger volume of polluted water can be treated. Also, this inorganic coagulant can almost completely remove fine colloidal particles from polluted water. This enables ultrapurified water from highly polluted water.

In a field experiment carried out in Hohrai Pond in Japan (water volume 300 m<sup>3</sup>), 60 kg of Econite was used which corresponded to about 0.02% of the total water weight. Suspended solid (SS) removal of about 98% was achieved, and the transparency of the pond water subsequent to the treatment was down to a depth of about 70 cm. The chlorophyll content, which represents the amount of algae in the pond water, was reduced to 4%. Fur-

Present treatment agents using polymer compounds require the addition of an auxiliary coagulant and the adjustment of the pH value subsequent to waste water treatment. The new system uses a natural treatment agent and eliminates these additional treatments, which considerably simplify the system facility. A system with a daily treatment capacity of 5 t is marketed at a domestic price of about ¥6 million, about one-fifth that of existing systems.

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Flow chart

pores which adsorb impurities, and calcium ions effused in water reacts chemically with other components of the treatment agent to intensify the effect of attracting impurities, so the treatment time is shortened substantially.

Econite features a significantly rapid settling velocity compared with JETRO, April 1998

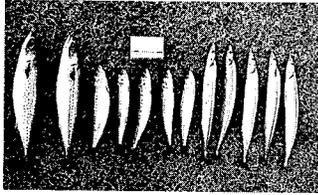
thermore, the pH value after the coagulant addition was around 7.2, indicating that this product is friendly to fish. It was also confirmed that Econite displays the same effect with food processing waste water (high settling velocity and ultrapurification by sedimentation of fine colloidal particles).

98-04-008-06  
**System for High-Speed Decomposition of Raw Garbage**

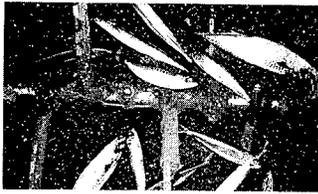
The Environment Purification Research Association has established a system for complete high-speed decomposition and extinction of raw garbage by using a special type of microbial agent.

## Decomposition process of raw garbage

### Example of fish



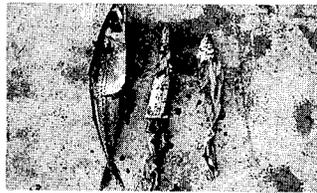
Fish for examination  
Mackerel, Sardine, Saury



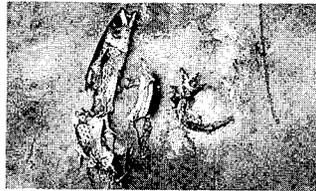
Charging into decomposer



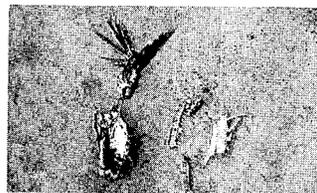
Sprinkling microbial agent



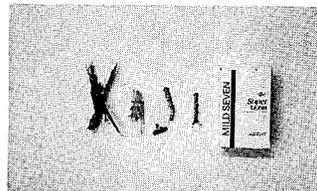
After 15 minutes



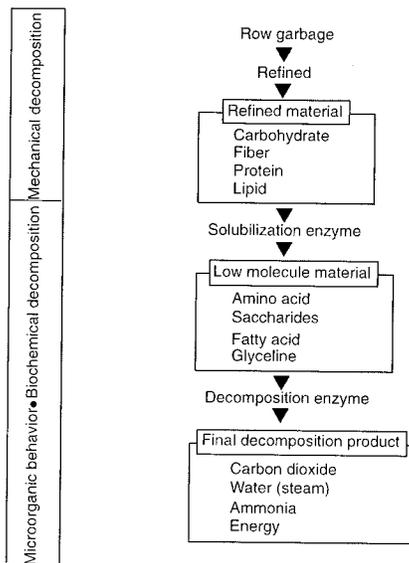
After 30 minutes



After 45 minutes



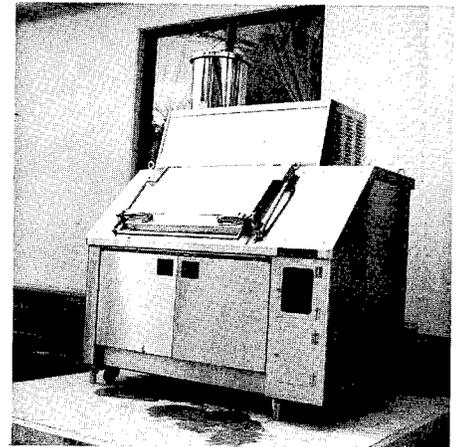
After 60 minutes



Decomposition process of raw garbage by using a special type of microbial agent

The special type of microbial agent is a mixture of aerobic, facultative anaerobic and anaerobic bacteria which become the most active at about 45 °C. To adjust the supply of oxygen and moisture and to maintain a good living environment for these bacteria, the floor of the treatment tank is made of a unique vegetable microbial medium.

A distinct system characteristic is the excellent raw garbage decomposition effect. Fish remnants are degraded in 2-4 hrs, leftover rice in 3-5 hrs, bony fowl meat in 8-10 hrs and pineapple peel in 10-15 hrs. Based on the special type of microbial agent and the system components which utilize the agent degradation capability to the maximum degree, raw garbage is almost entirely degraded in one day, and the treatment tank does not become full even when raw garbage is discharged into it continuously.



System for high-speed decomposition of raw garbage

Even bones are degraded, egg shells in about 2 days, and shellfish and the shells of large crabs and shrimps in about a week. Water vapor and carbon dioxide gas are exhausted into the atmosphere in the process of degradation, but no offensive odor is generated since the system is equipped with a high-performance deodorizing device. The system can treat 50 l of raw garbage at a time.

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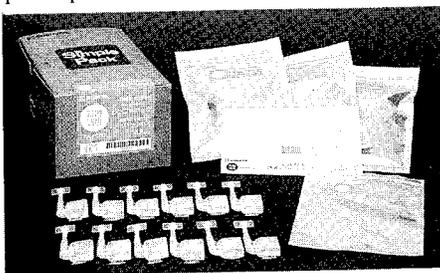
98-04-008-07

## Easy Water Test Kit

Sibata Scientific Technology, Ltd. is now marketing a new easily operated water test kit to inspect outdoor water quality levels. Simple Pack consists of a small plastic container for taking the sample of water to be tested a color sample sheet which indicates the quality level. In all, there are 15 Simple Pack models to choose from, each one with a different measuring objective, e.g. different tests for detecting the concentration of hydrogen ions or the concentration of residual chlorine.

A chemical reacting with specific types of substances is pre-packed inside the container, and whenever the target substance is present in the test liquid, the liquid turns red or blue. The color is compared to the reference color sample sheet to determine the concentration level of the substance.

Simple Pack is small and can fit in the palm of the hand (overall length 55 mm). It is light weight, and the kit nozzle knob is removed with simple twist. The pre-packed testing chemical in the collector tube provides fast result via a colored solution, generated in 10 seconds to a few minutes after shaking, so tests performed are simple and accurate without any complex operations.



Easy water test kit

Simple Pack is available in two versions. Pack A is used solely for measurements other than free cyanogen, and both Pack A and Pack B are used in combination when measuring free cyanogen. On-site tests are performed with ease on lakes and in factory compounds. A set containing 48 chemical vials markets for Japan is sold at a domestic price of ¥3,500-3,900.

\* Sibata Scientific Technology, Ltd.

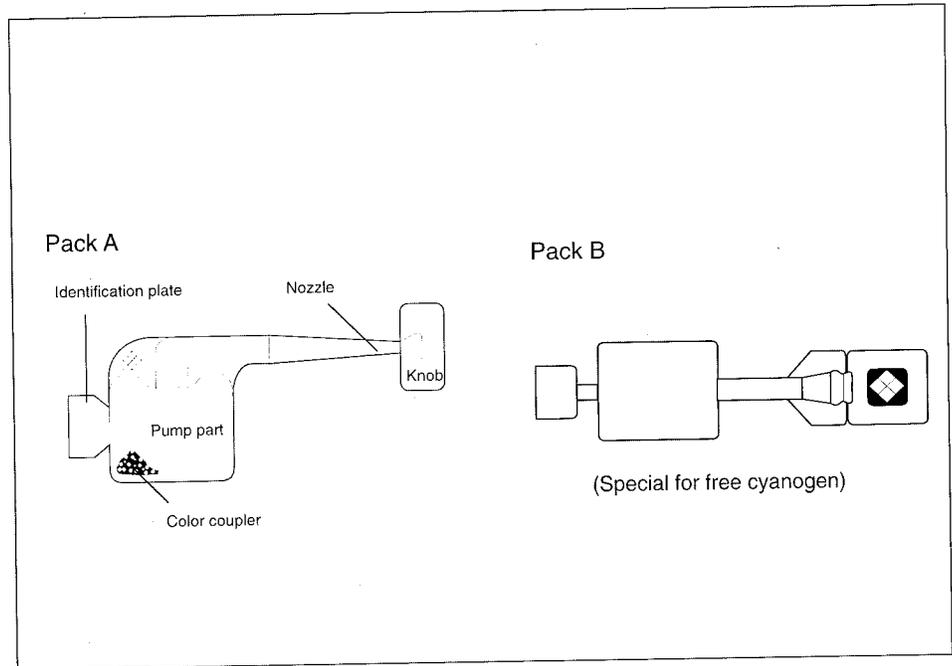
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JETRO, April 1998



Shape of pack

## Biotechnology & Medical Science

98-04-009-01

### Glutathione Protects Skin Immune Function From Ultraviolet Radiation

Shiseido Co., Ltd. has discovered that glutathione prevents the damage of Langerhans cells by ultraviolet rays and protects the skin immune function. Skin immunity is deeply correlated with the body immune system, so glutathione helps to maintain the skin and entire body in a healthy state.

Glutathione has an antiacidic effect, but has now been discovered to protect the skin immune function from ultraviolet rays. Immunity is a protective mechanism inherent to the human body. For example, when some foreign substance enter the body, the body recognizes the substance and attacks and repels the substance by mobilizing white blood corpuscles and lymph cells. This system of recognition, attack and repulsion is known as the immune function, and the human body can resist various types of foreign cells and viruses due to the immune function. The immune system is primarily governed by bone marrow, the spleen, the

thymus and the lymph system, but recent research revealed that the skin is also vital.

The skin consists of the outermost horny layer, the epidermal cell layer, pigment layer and Langerhans cell layer, and the deeper dermal layer consisting of the fibrous tissue layer and collagen tissue layer. The Langerhans cells comprise about 5% of the entire epidermal layer and capture foreign substances which infiltrate beyond the horny layer and protect the body from infections by activating the entire body immune system. The research team used the function of the Langerhans cell to proliferate the T-cells of immunity system cells as an indicator to identify various types of substances and eventually confirmed that glutathione prevents skin immunity deterioration by ultraviolet rays.

Glutathione consists of glutamic acid, cysteine and glycine, or three amino acids, and is a natural peptide. In general, it is produced artificially from yeast by biotechnology. Normally, glutathione is decomposed easily, making it difficult to blend into cosmetics, but the company estab-

lished a unique blending technique and will be marketing a new type of suncare products starting from the summer of 1998.

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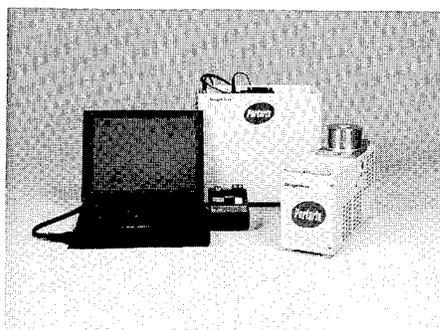
98-04-009-02

## Portable On-Site XRF Analyzer

Prof. K. Taniguchi, his research team of the Osaka Electro-Communication University and Rigaku Industrial Corp. have developed a portable X-ray analyzer capable of analyzing levels of 10 ppb. No radioisotope requiring handling with caution is needed, and the analysis accuracy has been improved considerably. It will be commercialized for use in urgent on-site analysis for conducting environmental analysis, archeological surveys and criminal investigations.

The X-ray analyzer is used to irradiate an X-ray beam on the specimen, and analyzes the types and quantities of elements contained in the specimen by analyzing the emitted X-rays. To simultaneously achieve analyzer miniaturization and high accuracy, an electrically cooled Si pin photodiode detector is used that requires no liquid nitrogen, as well as a miniature X-ray tube. In addition, a cylindrical crystal has been developed that monochromatizes and finely focuses the primary X-ray beam, for use in low background noise analysis.

The new analyzer consists of a head unit for conducting measurements, a pulse signal processing unit to amplify the measured signals and to convert them into digi-



Portable on-site XRF analyzer

tal signals, and a notebook type personal computer for data processing. The measurement head unit incorporates a miniature X-ray tube, a cylindrical monochromator, a semiconductor detector and a high-tension power unit to generate the necessary X-ray beams.

Conventional types of portable analyzers mostly use radioisotope as the X-ray source, so handling demands great caution and cannot be used readily outdoors. The detection unit generally has to be cooled by liquid nitrogen to get the desired energy resolution capability. In addition, the background noise is high, so these analyzers cannot be used for analyzing weak X-rays of less than 1 ppm.

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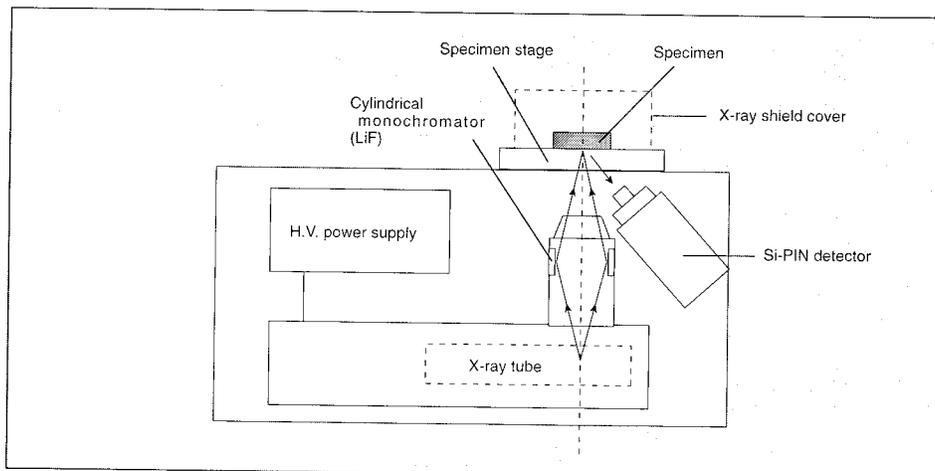
### Contact

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Schematic diagram of the measurement head in the XRF analyzer

98-04-009-03

## Propolis Blend Toothpaste and Mouthwash

H + B Life Science Co., Ltd. has begun marketing the PhX series of mouth care products which blends Hayashibara propolis. PhX is available as a dental paste and a mouth wash, both of which feature the effects of removing plaque and of cleaning the teeth to maintain the mouth in a highly sanitary state.

The primary causes of tooth loss are tooth decay and dental disorders such as periodontitis, caused by acids and toxic substances generated by bacteria living on plaque. Thus plaque removal is necessary to prevent these disorders.

Propolis is a substance generated by honeybees by mixing their secretions with plant fluids and plant fats gathered from plants. Honeybees are known to coat propolis on the inside of their hives to prevent infiltration of bacteria and viruses from the outside.

PhX blends Hayashibara propolis that is manufactured using enzyme technology and purification technology established by Hayashibara Biochemical Laboratories Inc. Hayashibara propolis is distinct in that the insoluble components such as wax which cause the offensive odor and flavor characteristic of propolis are removed, thus effectively increasing the water soluble substances, so that no unpleasantness remains in the mouth.



PhX series

\* **H+B Life Science Co., Ltd.**

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# FLASH

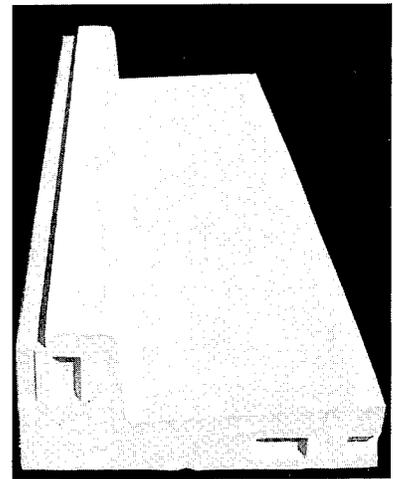
## Apron Block Prevents Roadside Weed Proliferation

MINAMI Co., Ltd. has started sales of its newly patented Weed Suppression Apron Block that prevents roadside weed proliferation. The block is arranged in a unique segmental notch form at the boundary parts between car lanes and pedestrian sidewalks to prevent the proliferation of weeds.

Conventional types of weed prevention blocks are installed with their lateral faces vertical to the car lane asphalt on the sidewalk side, so that weed seeds used to infil-

trate into the gaps, then germinated after rainfall to proliferate the weeds. The new Weed Suppression Apron Block forms a notched segmental region at the asphalt boundary part that effectively increases the area of contact and prevents weed seeds from germinating due to the intense action of the sun heat.

Using the new apron block improving the aesthetic appearance of sidewalks, and considerably decreases the labor necessary for weeding.



Apron Block

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## Composite Type Road Mirror

HOSEI Composite Mirror Co., Ltd., by applying its patented technologies relating to aspherical mirrors, has developed a new type of road mirror that is entirely different from its existing mirrors and features wider fields of vision, more accurate sense of distance, and considerable elimination of the unrecognized zone.

The Composite Type Road Mirror is a special type of road mirror that simultaneously features the two major characteristics of showing the accurate sense of distance and of expanding the field of vision. As shown in the accompanying diagram, the mirror has a fixed radius of curvature at central part and gradually reduced radius of curvature at the peripheral part.

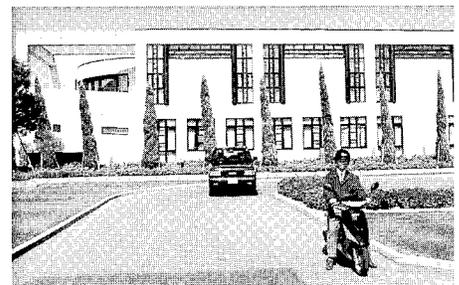
The central part has a maximum radius of curvature of R3,600 mm as prescribed by the Road Reflection Mirror Designing Guideline, and an accurate sense of distance is obtained by bigger mirror images. Meanwhile, the peripheral part starts out with R3,600 mm and the final radius of curvature is the minimum radius of curvature of R2,200 mm prescribed by the Road Reflection Mirror Designing Guideline, gradually reducing the radius of curvature

of each surface to form a fluent curved surface with no distortion. As a result, natural mirror images are obtained in the same mode as that of the fixed radius of curvature, and a wide field of vision is also secured.

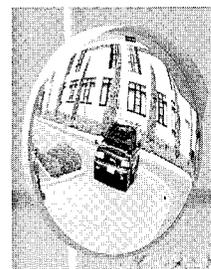
The Composite Type Road Mirror was developed by applying the company technology relating to aspherical mirror (side-mirror) for cars that incorporates the characteristics of accurate visual recognition of the plane mirror and wide angles of vision of the curved mirror.

Existing mirrors are available in the three types of  $\phi 600$ mm, R2,200 mm,  $\phi 800$ mm, R3,000 mm and  $\phi 1000$  mm, R3,600 mm for use in conformance with the specific needs, and are simple curved mirrors. However, the characteristics of showing in accurate sense of distance and of expanding the field of vision are inconsistent, so that when the angle of vision is widened, the accurate sense of distance is deteriorated.

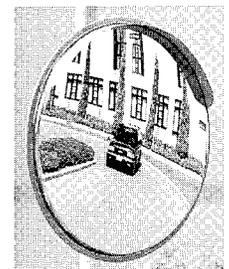
The newly developed mirror (Composite Type Road Mirror) expands the field of vision by 11 degrees in all directions, while the central part of mirror provides images



Object



Composite type



Ordinary type

of adequate size and transmits an accurate sense of distance and motion of the target images to the driver. In addition, since the Composite Type Road Mirror incorporates the functions of the three types of existing mirrors, it is usable under all kinds of road conditions.

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**JETRO**

**Japan External Trade Organization**

**Machinery and Technology Department**